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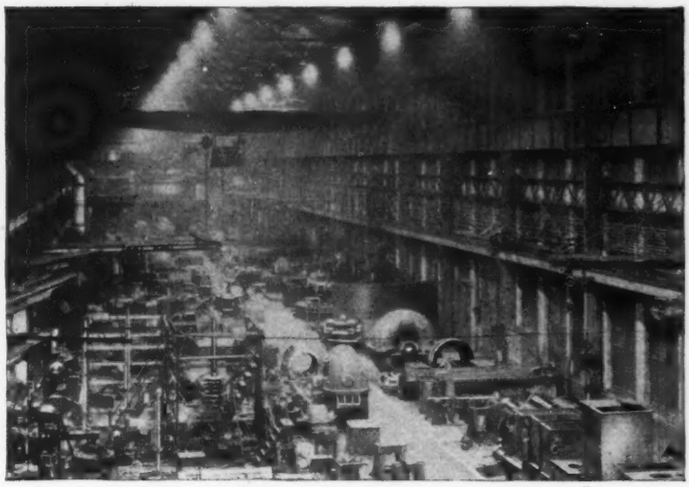

River Works
General Electric Company

AUGUST 30, 1930

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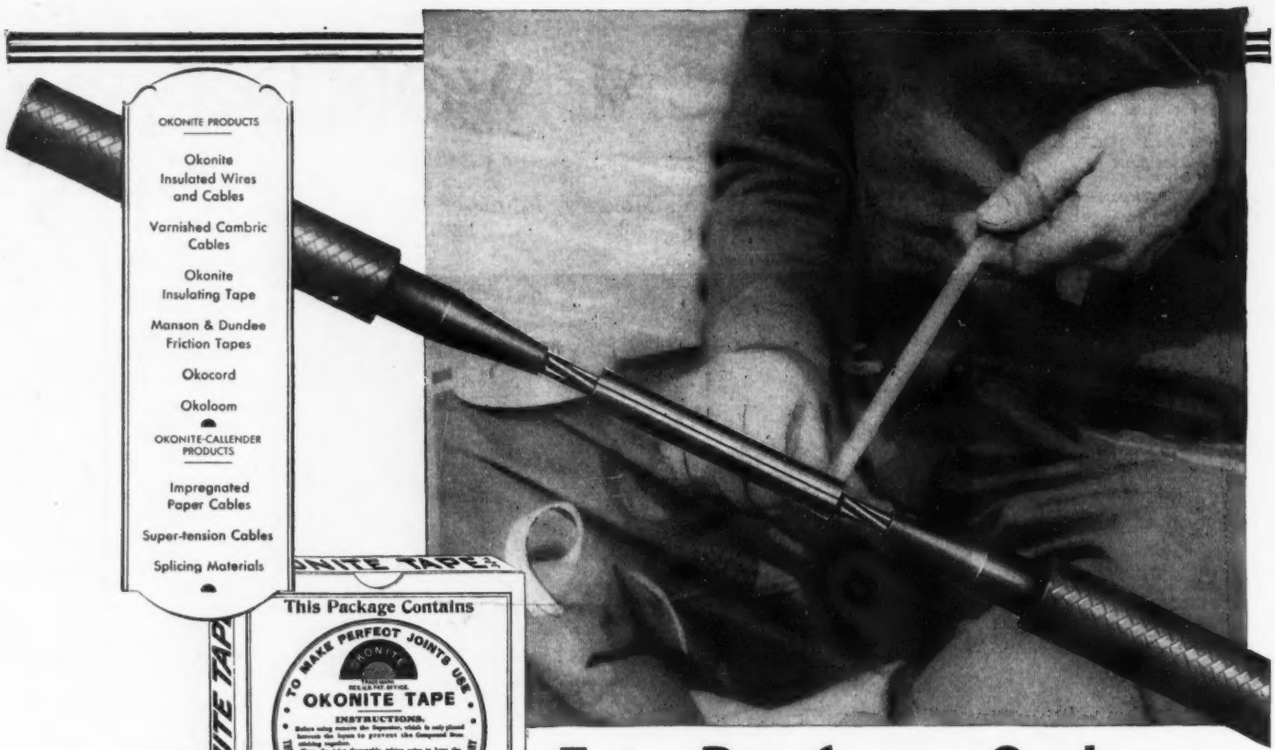

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ELECTRICAL WORLD

for the Week Ending

August 30, 1930

Proposed power bonds are buried by San Francisco voters

—THREE-TO-ONE majority overwhelms proposal to buy distribution systems for Hetch Hetchy in San Francisco.

—WATERVILLE, new 147,000-hp. hydro plant of Carolina Power & Light Company, involves 6-mile tunnel bypassing 12 miles of river and operates under 861-ft. head.

—1,000 DEG. F. is steam temperature for British 10,000-kw. unit installed at Detroit Edison station and scheduled for early operation.

—UTILITY EXECUTIVES almost unanimous in concluding that worst of depression is over. Confidential reports from all sections show business slowly picking up.

—NORWAY finds that lower rates lead to increased energy use. Director of State Electricity shows experience abroad to corroborate that developed here.

Rate cut to beat municipal plant brings Georgia inquiry

Clarion River costs grossly inflated, Federal Power man asserts

—POWER COMMISSION accountant attacks $11,000,000 plant cost of Clarion River Power Company. Should be nearer $4,500,000, he says, charging various and sundry inflations of investment.

—GEORGIA city gets 50 per cent rate cut on utility energy, beating competitive county-hydro rates by 25 per cent. Why not a 50 per cent cut in other cities? commission asks.

—MERCHANDISING promotion expenditures largely a waste, concludes an important utility executive, who also questions the value of inducement rates, but prefers to remain anonymous.

—8 PER CENT RETURN difficult to justify, says Indiana commission chairman, when other businesses are in the red. "Going value" attacked as a rate-base item.

NEWS OF THE WEEK

Power Commission Officials Talk About Accounting and Scenery

DECLARING that the whole federal water-power act is "merely an idle gesture" if the Federal Power Commission has no authority to require a licensee to omit from its capital account an item of cost representing an expenditure actually made, as is contended by the Lexington Water Power Company, the solicitor for the commission, Charles A. Russell, at a recent hearing before an examiner, continued:

"If that contention is true, it means that the federal water-power act gives to the Federal Power Commission merely the right to sit idly by in a state of 'innocuous desuetude' and rubber-stamp the practices, the procedure, the thought and determination of the power companies. That Congress had any such intention in the passage of the act is beyond comprehension and is negatived by the provisions of the act."

The hearing was called when the company protested against elimination by the accounting division of the commission, in a preliminary accounting report on the Saluda project in South Carolina, of items to a net amount of $412,195.

"It would seem," the company's brief says, "that the Federal Power Commission has no jurisdiction to adjudicate in advance the question what constitutes the net investment in the project and hence has no power to make an order allowing or disallowing items of cost included by the licensee, on the theory that they are not proper charges. The act contemplates that the question of net investment is to be determined at the time the government exercises its option to recapture the project."

The case, it is said, is the first that has ever arisen over elimination of items from pre-license cost statements.

Bonner on scenery issue

Another Federal Power Commission officer, Executive Secretary F. E. Bonner, recently commented on the Attorney-General's decision in the Cumberland Falls case to the effect that the commission had no duty to consider the esthetic but only the navigational aspects of the proposed development. In a letter to Seth E. Gordon, conservation director of the Izaak Walton League of America, Mr. Bonner asserted that this decision had no general application and expressed the commission's sympathy with the preservation of natural attractions. He said:

"Of the 447 licenses outstanding on July 1, 1930, only five relate to projects of the same classification as the Cumberland Falls case. The great majority, of course, consist of those which involve the use of government land, and in such cases there can be no question of the commission's authority under the present law to give full consideration to all factors which may be of public concern."

It is fully expected that amendments will be proposed at the December session of Congress which will restrict the commission in the granting of licenses for scenic sites.

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Call Cumberland Falls Valuation Exorbitant

A VALUE of $1,186,000 has been placed by the majority of the appraisers appointed by a county court upon the property of the Cumberland Power Company, including Cumberland

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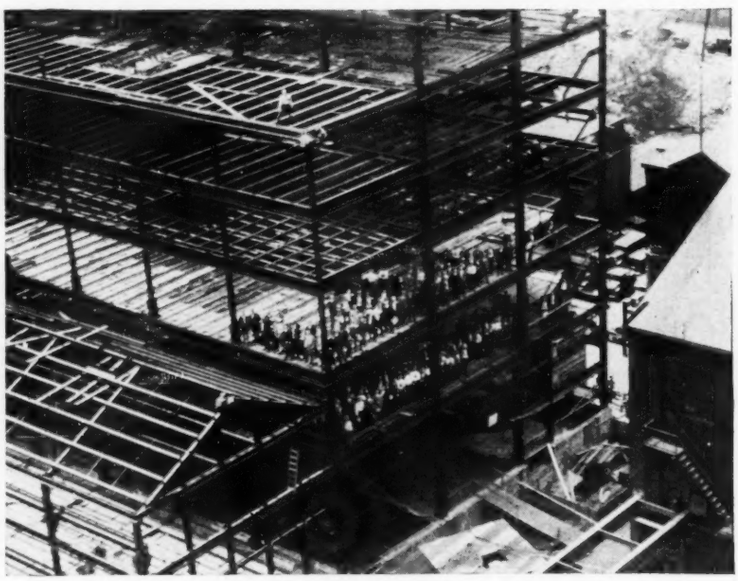
A.I.S.E.E. MEN INSPECT ARC WELDING



Members of the Pittsburgh Chapter of the Association of Iron and Steel Electrical Engineers recently inspected the central engineering laboratory now under construction at the East Pittsburgh plant of the Westinghouse Electric & Manufacturing Company and said to be the largest arc-welded structure in the world.

Falls, which the Kentucky Legislature ordered to be acquired as the site of a state park. The minority appraisers valued the site at $190,000. Even this state officials declare to be too much, the Attorney-General's department contending that $125,000 would be ample and that the majority finding was an "outrage." The award will be submitted to a jury.

▼

King Would Slash Cost Figure of Clarion Power

WILLIAM V. KING, chief accountant of the Federal Power Commission, has recommended that the costs of promoting and building the Clarion River Power Company's hydroelectric development in Pennsylvania, reported by the company as $11,032,000, be cut to $4,645,000. According to Mr. King, the alleged inflation of costs was based on several things. He said that $800,000 represented fees charged by the controlling interests to their utility, power and construction subsidiaries, and that stock sold far under par was charged at its face value, $3,000,000 extra costs being recorded in this way.

Other accusations made by Mr. King were that the Clarion River company credited receipts from sales of energy at only 5 mills a kilowatt-hour instead of 8 mills, the sum received, and that the expenses of a "grand opening" and even a bill for 48 neckties were included.

The Clarion River Power Company, with headquarters at Johnstown, Pa., is controlled by the Associated Gas & Electric Company through the Pennsylvania Electric Corporation.

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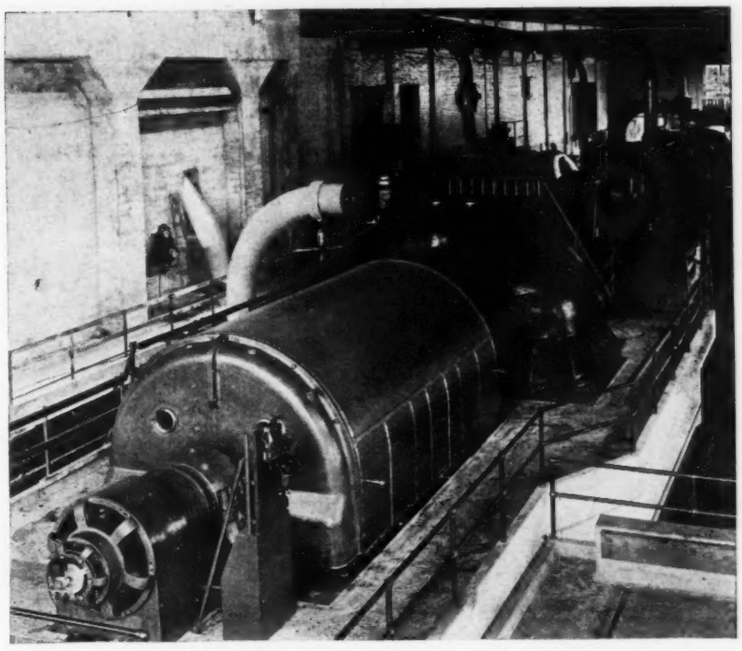
Nebraska Power Company "Calls" Senator Howell

CHARGES said to have been made in a radio talk by Senator R. B. Howell of Nebraska to the effect that the Nebraska Power Company and other power companies in that state have united to fight Senator Norris and finance the campaign of his opponent have met a prompt and emphatic denial from the utility named. Through its president, J. E. Davidson, the Nebraska Power Company says in a four-column advertisement in daily newspapers:

"It is regrettable that we must step forward and publicly brand Mr. Howell's statements as false. The Nebraska Power Company has not contributed one cent to the campaign fund of Mr. Stebbins, and we have taken no part in furthering his candidacy. We call upon Senator Howell to come forth with his evidence and show proof to substantiate the charges he made publicly over radio and through the press."

HERE IS THE ANSWER TO DROUGHT THREATS



For the second consecutive year scarcity of rainfall threatens to hamper hydro plants in Oregon. The Pacific Northwest Public Service Company was not caught napping. It has just put in service a new 35,000-kw. General Electric turbo-generator, bringing the total rating of its "L" steam station to 77,500 kw.

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San Francisco Bonds Beaten Three to One

OVERWHELMING defeat met the four proposed bond issues to enable the city of San Francisco to take over the distribution systems of the Pacific Gas & Electric and Great Western Power companies when the voters were heard from on Tuesday last. The adverse majority is estimated at about three to one, exact returns being not yet available. This proportion was fairly uniform throughout the city.

As recorded last week in the ELECTRICAL WORLD (page 331) and previously in more detail (June 7, page 1110), these issues, totaling $68,115,000, with a necessary additional $17,000,000 which it was hoped would accrue from power revenues, were intended to enable the city to distribute its own power from the Hetch Hetchy municipal plant. The Board of Supervisors and labor organizations favored the project, but business interests were arrayed against it. Hetch Hetchy power is now distributed by the private companies under agreement with the city.

Washington to Study Its Municipal Power Needs

WASHINGTON CITY'S own power needs, as distinct from those of the federal government or of private consumers, will probably soon be made the subject of research by an electrical expert or firm to be appointed by the District of Columbia commissioners. This will be in accordance with a clause in the appropriation act passed by Congress at its late session which set aside $25,000 for the purpose.

According to Major Donald A. Davison, assistant engineer commissioner with supervision over the electrical department, the survey will cover street lighting, the light and power needs of the public schools, police stations, fire-engine houses and other public institutions. Major Davison indicated that whoever is selected to make the survey will be asked to give a dollar-and-cent comparison of the present cost of supplying light and power for these city purposes with the estimated cost of a municipally owned and operated plant.

It is not expected that a final report on the survey will be ready for Congress this fall, but the municipal authorities hope to have the work under way in time to report progress.

500,000,000 CP. OF COLORED SEARCHLIGHTS

General Electric Company

Kaleidoscopic effects are obtained in the lighting of the Union Trust Building in Detroit. On the higher of the two towers, 42 stories above the street, is a battery of 36-in. units so arranged that at each corner of the eight-pointed tower adjacent searchlights revolve in opposite directions, oscillating vertically at the same time

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Projects Before Federal Power Commission

A MEETING of the Federal Power Commission is to be held in the near future to pass upon the application of the California-Oregon Power Company for a license on the Klamath River. While this project calls for the ultimate development of 275,000 hp., present plans are for the installation of only 75,000 hp. It is expected that the commission will approve the application. The commission is expected also to approve at this meeting a preliminary permit for the Pacific Gas & Electric Company's Bear River project in California, which would supplement the large development of that company on the Mokelumne.

The California-Oregon Power Company has filed an application for a license covering its proposed development on the North Umpqua and Clearwater Rivers in Douglas County, Ore. This includes four projects—Rock Creek, Boundary, Toketee and Lemolo—on the North Umpqua and one unit on the Clearwater River. On the North Umpqua a fall of 2,648 ft. in the 57 miles of river between the mouth of Rock Creek and the mouth of Lake Creek will be utilized. On the Clearwater there is a fall of 1,450 ft. in the lower 7½ miles of the river. Water will be diverted into that stream from Watson, Fish and Rough Creeks. There will be two power houses at the Lemolo site and at the Clearwater site. The primary power that thus will be made available is estimated at 117,915 hp. It is planned, however, to install 250,300 hp. The application for license is made in pursuance of a preliminary permit issued August 15, 1927.

The Southern Sierras Power Company has applied for a license covering an 88-kv. transmission line, 70 miles long, extending from Calipatria to Blythe.

The South Branch Power Company of Philadelphia has filed an application with the commission for a preliminary permit covering a 25,000-hp. project on the south branch of the Potomac River and on the Cacapon River in West Virginia. This is a portion of the original project of the company, which included dams on the Potomac and Shenandoah Rivers. Power development on the Potomac is precluded by the act creating the George Washington Memorial Parkway. Under the revised project it is planned to build four dams on South Branch and two dams on the Cacapon.

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Northwest Inspectors Gather at Bellingham

A PLEA for a simpler code confining itself to the avoidance of demonstrated hazard and free from restrictions which tend to hamper the development of the art was made in a paper which R. M. Boykin, Electric Bond & Share Company, New York, presented before the fifth annual convention of the Northwestern Section, International Association of Electrical Inspectors, held at Bellingham, Wash., August 25-27. W. S. Boyd, president of the parent body, and A. Penn Denton of the National Electrical Manufacturers' Association also gave addresses, the latter saying that the maximum superstandards of yesterday become the minimum safety standards of today. Committee reports dealt with the relation in the code between adequacy and safety, vertical bus distribution in buildings, range wiring, radio and metal wireways.

Officers elected were: President, C. E. Foster, Astoria, Ore.; vice-president, J. A. Casey, Walla Walla, Wash.; secretary-treasurer, F. D. Weber, Portland. Salem, Ore., was chosen for next year's meeting.

▼

Five Maine Companies Protest Wholesale Rate

PROTEST has been made to the Maine Public Service Commission by five Aroostook County electric distributing companies against a wholesale rate of 4 cents a kilowatt-hour charged them by the Maine Public Service Company. The petitioners are the Fort Fairfield Light & Power Company, Limestone Electric Company, Washburn Electric Company, Van Buren Light & Power District and the Mars Hill Electric Company.

These companies, declaring that the 4-cent rate is discriminatory, unreasonable and excessive, demand a complete inventory and appraisal of the Maine Public Service Company's properties—a request unusual in Maine.

The Maine Public Service Company is a property of the Pierce interests of Chicago, which also control the Maine & New Brunswick Electric Power Company.

J. W. McCardle Gives Views on Utilities to American Bar Association

MINGLING praise and blame, John W. McCardle, chairman of the Indiana Public Service Commission, entered into a discussion of public utilities and their regulation before the American Bar Association at Chicago on August 19. He defended the companies' efforts at educational publicity, criticising the "journalistic furor which accompanied the earlier stages of the Federal Trade Commission's investigation" as unfounded and profitless. Sensational newspapers he held to be largely responsible for poor public relations between the utilities and their customers, but he also thought some of the practices and methods of the companies faulty—among them, insisting on too high a rate of return, bothering the people with questionnaires, forming mergers not followed by any benefit to the consumers, asking that "going value" be included in valuation, and presenting widely varying property appraisals by their engineers. Some of Mr. McCardle's remarks in these conections follow:

One of the factors which have created bad feeling is the insistence of some utility operators upon too large a return on the value of their property. Such insistence is not wise, even though the contentions of the utility may be upheld by the courts. Many utilities demand as much as 8 per cent return, and it is difficult to justify such a return when so many other businesses find themselves on the red side of the ledger with high operating expenses and no return at all upon their investments. . . .

Some of the utilities in our state are making a survey of the territory outside the towns and cities, and in this survey they use an inquiry card which consists of 54 questions. Often the use of this questionnaire irritates the prospective consumer and really elicits very little beneficial information. . . .

Mergers and consolidations have been taking place, and the question arises: "What benefit inures to the general public?" It is true that in granting these mergers and consolidations the commission attempts to be fair to the public as well as to the utility; but the merging of properties in Indiana in many cases has not lessened the burden of the consumer, and this result, or lack of result, has been emphasized and broadcast far and wide by the press, thereby creating a very unsettled relation between the utility and the patron. . . .

"Going value" alone is a serious bone of contention between public and utilities throughout the country. Who ever believed when the utility business was in its infancy that the time would come when "going value" would be added to increase value upon which return is based? . . . The utilities do not need the protection of "going value." The Indiana law practically guarantees a reasonable return on the reasonable value of the property, including maintenance and depreciation, and also guarantees against competition—the one thing upon which "going value" is predicated. Too much cannot be said against this element of value, and the sooner it is ignored the better it will be.

Another outstanding element in the widening breach between utilities and the general public is the appraisal work done by the utility engineers. No two engineers, taking the same property, the same unit prices and the same locality, can arrive at the same figure. . . . Unless something is done to keep the engineers from theorizing or following some one who has laid down fanciful figures and rules, the engineering part of the utility program will speedily fall into greater disrepute than ever before. Indeed, it seems probable that in view of such wide divergences between the estimates of various engineers the basing of values upon engineering estimates will eventually fall into disuse.

Accrued depreciation, the commission now suggests, should be taken into account in the annual adjustment. Thus an additional factor would be employed in reducing the bills of the customers.

▼

Commission Asks Still Lower Potomac Rates

PROPOSALS were submitted by the Public Utilities Commission of the District of Columbia last week to the Potomac Electric Power Company which had as their end a still further reduction in the utility's lighting rates. Under an existing agreement between the commission and the company any excess of profits over 7½ per cent in any year is followed by a reduction in rates intended to give the customers half the amount of this excess in the following year. Rates have been annually reduced since the agreement was made.

▼

Commission's Power to Fix Exact Rates Upheld

DECISION recently rendered by the Montana Supreme Court upholds the Public Service Commission of that state in fixing an exact gas rate against the contention of the Great Northern Utilities Company that the regulating body was empowered to fix only a maximum rate and that the utility had a right to supply customers at less than the rate fixed if it chose to do so. The company maintained that for the commission to fix exact rates would be violative of both the state and the federal constitutions.

▼

Two Rate Surveys Now Under Way in Toledo

SIMULTANEOUSLY with a comparison of the average bills for electrical rates in Toledo homes with those in homes in surrounding cities which is being made by a subcommittee of the City Council, the Toledo Edison Company is conducting a survey of the number of home consumers of electricity and the average amount used by each customer. This survey will be completed about October 1.

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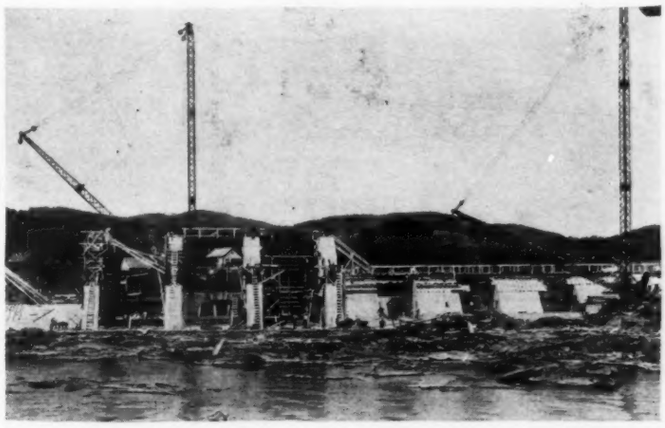
FIFTEEN-MILE FALLS AUXILIARY PLANT



To utilize the flowage of the Connecticut River more effectively below the Fifteen-Mile Falls lower development of the New England Power Association, the construction company will install four 3,300-kva. vertical units at McIndoes Falls, 7 miles below "Fifteen." The reinforced-concrete dam, 520 ft. long, will create a head of 27 ft.

Contract Let for Big Project on the Abitibi

WORK will commence at once on the twenty - three - million - dollar power project of the Hudson's Bay Power Company on the Abitibi River in northern Ontario, following the announcement of the awarding of the contract to the Dominion Construction Company of Toronto. This is one of the largest public utility undertakings in the province, and the work is expected to take about two years, power to be delivered by October 1, 1932. The location of the power site is about 64 miles north of Cochrane, Ontario, and only a few miles from the main line of the Temiskaming & Northern Ontario Railway, from which a spur has already been built to carry construction materials to the scene of the undertaking. The Abitibi Canyon water power will be developed under a head of 237 ft. Details of construction show that a concrete dam is to be erected on solid rock foundations, and the power house to be erected in the gorge below will contain five generating units of not less than 55,000 hp. each.

This power is to be developed for the Hydro-Electric Power Commission of Ontario and the Abitibi Power & Paper Company. The Hydro contract runs for 40 years, 85,000 hp. to be delivered upon completion of the plant and 100,000 hp. in 1936. To deliver power at Sudbury, where an urgent demand exists in connection with nickel-copper mining operations, will require one of the longest transmission lines in Canada. The distance from the power site to Sudbury is about 250 miles. This line will be built by the Hydro at an estimated cost of $3,500,000.

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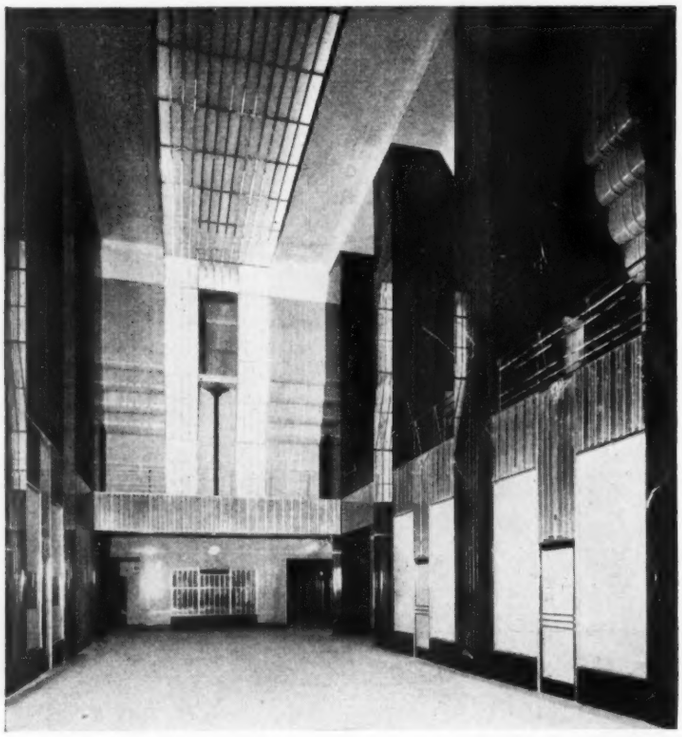
LIGHT AS AN ELEMENT IN ARCHITECTURE



UTILIZATION of light as an integral part of architectural design is well exemplified in the main lobby of the new Chicago Board of Trade Building. A broad ribbon of light—12 ft. wide and 128 ft. long—extends the length of the ceiling with parallel strips down both end walls. The installation, of 50 kw. connected load, is believed to contain the largest expanse of glass yet used with a flush-type fixture. The lighting is indirect. Back of the sand-blasted glass panels is a continuous reflector, and the lamps (160 of 150 watts in the ceiling path and 432 of 60 watts in the end wall strips) are arranged along the sides. The surface light intensity on the glass is low so that the light is not obtrusive in the general impression, but the glass area is so large as to allow a satisfactory illumination intensity in every part of the lobby. Holabird & Root, architects, designed the installation.

Exteriorly the Board of Trade will be one of the most brilliantly flood-lighted structures in America. The projectors will number 363, of which 153 will contain 1,000-watt lamps, 146 500-watt and 64 200-watt units.

▼

P. G. & E. Exceeds Its Construction Estimates

CONSTRUCTION expenditures in 1930 by the Pacific Gas & Electric Company well in excess of those estimated are indicated in a statement made public this week by President A. F. Hockenbeamer. The company, he says, has paid out $22,973,000 for new construction during the first six months of 1930 and now has 3,000 more men on its payroll than it had a year ago. These figures compare with an estimate of $35,000,000 for new construction for the entire year 1930 made by Mr. Hockenbeamer last November at the request of President Hoover's National Business Survey Conference.

"The figures indicate clearly," said Mr. Hockenbeamer, "that the company has not curtailed its construction program in the least. Not one order has been canceled, and it is our intention to proceed with construction as planned. In fact, 1930 expenditures to date have been slightly in excess of those for the same period last year. Total expenditures for new construction for the year 1929 amounted to $35,357,194."

In addition to the $22,973,000 which the Pacific Gas & Electric Company spent for new construction during the first half of 1930, expenditures by the recently absorbed Great Western Power and San Joaquin Light & Power companies were $7,335,000.

▼

Hydro Plants on Oswego Forced to Curtail Output

USE of the waters of the Oswego River by power plants and paper mills at Phoenix, Fulton, Minetto and Oswego, N. Y., has been greatly curtailed by Guy W. Pinck, district State Engineer, with headquarters in Syracuse. Explaining that the river is at the lowest stage in the fifteen years' history of the Barge Canal, Mr. Pinck said that plants would not be permitted to use full flow until conditions got back to normal, which, it was hoped, would be by September 1. The principal power plants affected were those of the Oswego Falls Corporation and the Fulton Light, Heat & Power Company, the Niagara plant at Minetto, the Oswego River Power Corporation's plant and the city-owned plant at Dam 6, Oswego, which is leased to the Carlisle interests.

Coming Meetings

American Institute of Electrical Engineers — Pacific Coast convention, Portland, Ore., Sept. 2-5; Middle Eastern District, Philadelphia, Oct. 13-15; Southern District, Louisville, Nov. 19-22. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 3-5. Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

International Association of Electrical Inspectors—Jacksonville, Fla., Sept. 8-11. Western Section, Congress Hotel, Chicago, Sept. 15-18. W. S. Boyd, 175 Jackson Blvd., Chicago. Eastern Section, Pittsfield, Mass., Sept. 22-24. R. Walker, 85 John St., New York.

Maryland Utilities Association—Chesapeake Bay cruise to Jamestown and Yorktown, Va., Sept. 11-13. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Empire State Gas and Electric Association—Saranac Inn, N. Y., Sept. 18 and 19; Meter Section, Watertown, N. Y., Oct. 9 and 10. C. H. B. Chapin, Grand Central Terminal, New York.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Sept. 25-27. T. C. Polk, 20 North Wacker Drive, Chicago.

American Electrochemical Society—Hotel Statler, Detroit, Sept. 25-27. C. G. Fink, Columbia University, New York.

National Safety Council—Pittsburgh, Sept. 29-Oct. 4. W. H. Cameron, 20 North Wacker Drive, Chicago.

New England Division, N.E.L.A.—New Ocean House, Swampscott, Mass., Sept. 29-Oct. 1. Miss O. A. Bursiel, 20 Providence St., Boston.

Illuminating Engineering Society—Hotel John Marshall, Richmond, Va., Oct. 7-10. E. H. Hobbie, 29 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Franciscan Hotel, Albuquerque, N. M., Oct. 20-22. O. H. Weller, Public Service Co. of Colorado, Denver.

National Electrical Manufacturers' Association — Chamberlain-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 20-24, A. W. Berresford, 420 Lexington Ave., New York.

National Electrical Wholesalers' Association—Pittsburgh, Nov. 10-14. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners — Charlotte, N. C., Nov. 12-15. J. B. Walker, 270 Madison Ave., New York.

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New Operating Companies to Be Formed at Portland

PAVING a way for the Pacific Northwest Public Service Company, Portland, to separate its power and street-railway business into two operating subsidiary companies, the City Council has passed an ordinance permitting transfer of the existing franchises. The company expects immediately to proceed with plans for the formation of the Portland General Electric Company, to take over the power and light franchises and physical property, and the Portland Traction Company, to take over the street-railway franchises and property. The complete segregation of the two departments is desired by the company to facilitate strict compliance with the recent order of the Oregon Public Service Commission and to facilitate negotiations with the City Council on any possible new street-railway franchises.

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Virginia Cities Act on Selling Their Plants

BY A VOTE of 510 to 303, citizens of Waynesboro, Va., have sanctioned the sale of the city-owned light and power plant to the Virginia Public Service Company, which already supplies part of the city with energy.

A bid of $1,100,000 for the electric light and power plant and the telephone system owned by the city of Martinsville, Va., was rejected by members of City Council last week. The telephone system was sold separately.

▼

British-Made Unit for Delray No. 3 Is Ready

ASSEMBLY of a British Thomson-Houston high-temperature turbo-generator in the Detroit Edison Company's Delray power house No. 3 was started during the first week in July and, the company's publication, the *Synchroscope*, says, should be finished in time to meet the scheduled turnover date of September 1.

This unit has been under construction for two years. Though rated at only 10,000 kw., it has unusual features which make it of special interest and which made slow construction advisable. Trouble was encountered with nearly every cast part used in the high-temperature section, owing to the difficulty of obtaining sound castings from the alloy steel selected to withstand the high temperature.

The high-temperature casing was made in one piece. The diaphragms holding the steam nozzles between stages are held in place by an inner lining or secondary casing having a horizontal joint. The corrugated piping bends which connect the high- and low-pressure elements are being used extensively in England for providing flexibility in steam lines where building space is restricted. The manufacturers of this piping state that the corrugated bends are five times as flexible as the same-size bends made from plain pipe, which allows the use of bends approximately one-fifth as large as those now necessary for a given expansion.

The generator will be excited by two direct-connected exciters instead of the one unit customary in this country. This type of excitation tends to make the generator operation more stable during electrical disturbances. The generator housing has a flat top provided for the installation of quick-opening doors that are used in case of failure of the air cooler.

A Babcock & Wilcox superheater will supply the high-temperature steam to the unit. The turbine will be run with station steam at 400 lb. pressure and 725 deg. F. until the additional superheating equipment is installed some time in October. The superheater will be separately fired with fuel oil and will raise the station steam to 1,000 deg. F.

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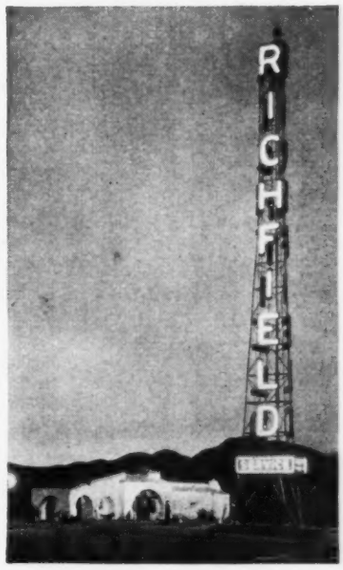
BEACON ADVERTISING ON THE COAST



Thirty of these 125-ft. steel towers dot the Pacific Coast from Palm City, on the Mexican border, to Blaine, Wash., on the Canadian line. An 8,000,000-cp. revolving beacon on the top points the way to the nearest airport. They are pioneers in what has been christened "land-air" advertising.

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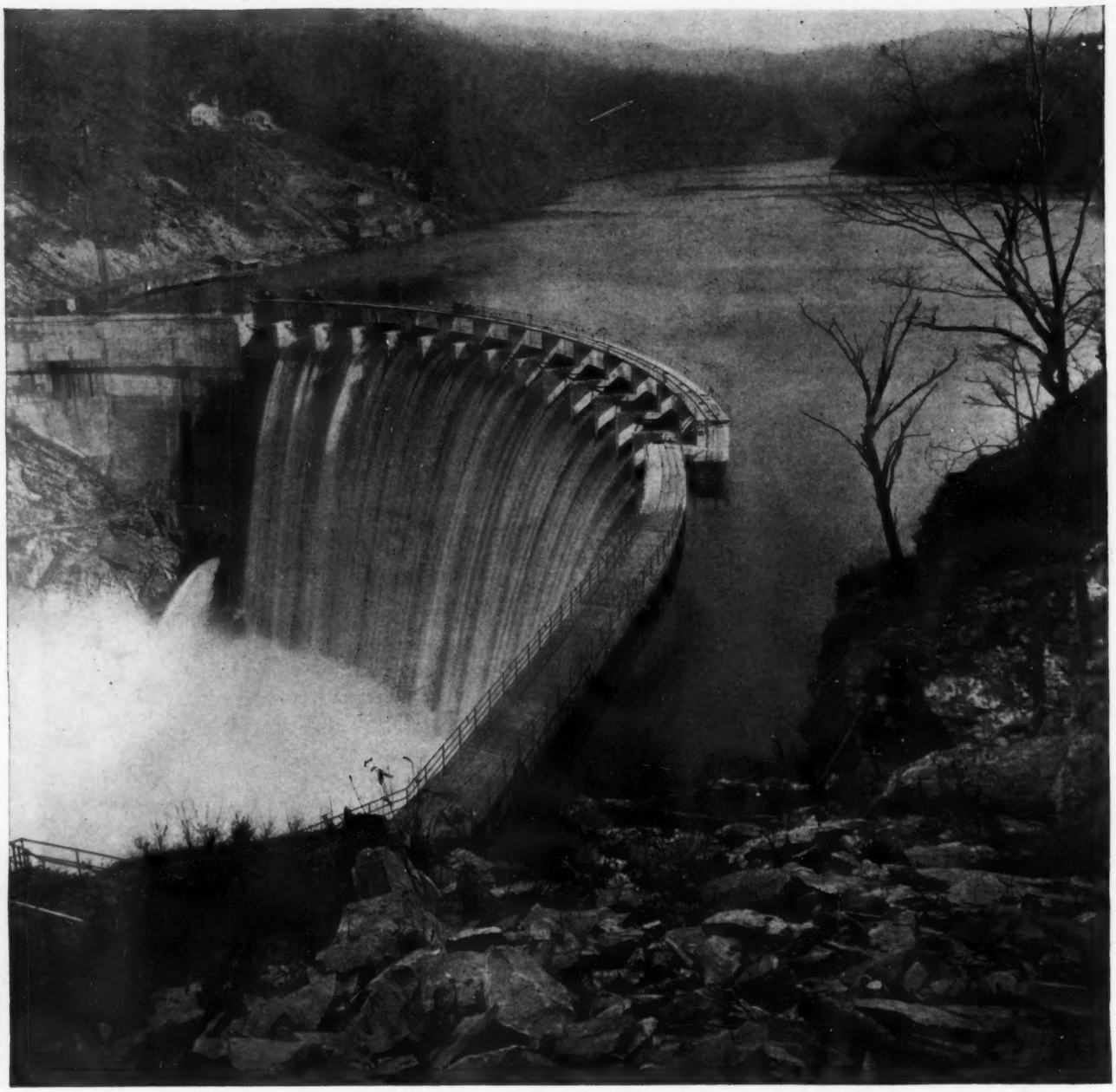
Georgia Power Company Cuts Rates at Cordele

RECENT reduction of 50 per cent by the Georgia Power Company of its rates at Cordele, Ga., thus, it is said, bringing them 25 per cent under those of the competitive Crisp County hydro plant recently put into service in that place, has bought from the Georgia Public Service Commission an order calling on the power company to show cause on September 2 why a 50 per cent reduction should not be made in the other cities served by it.



WATERVILLE SERVES SEVERAL SYSTEMS

WATER at this Big Pigeon River dam operates the new 108,000-kw. plant of the Carolina Power & Light Company at Waterville, N. C., built primarily to supply the growing load around Asheville but interconnected by short lines with the Tennessee Public Service Company, Appalachian Electric Power Company, Tennessee Electric Power Company, and Duke Power Company

EDITORIALS

L.W.W.MORROW
Editor

Handling Direct Lightning Strokes

DEBATE prevails as to whether transmission-line troubles are due mostly to induced or mostly to direct lightning strokes. None can prove the case as yet, and the probable answer is that both cause trouble, greater frequency characterizing the presence of induced strokes and greater severity being associated with direct strokes.

Whatever the theory or fact, the problem is to protect a line from lightning, and anything that will protect it against direct strokes is fairly certain to eliminate all induced-stroke troubles. And the job of protection is one of spending money intelligently. Build either a completely protected line, one protected against the majority of strokes, or one that takes the strokes without other protection than quick isolation, thus incurring temporary service interruptions. What to do is an economic and service question for each individual situation.

But if it is economical and desirable to protect a line completely against lightning, then there arise questions as to the best and cheapest way. In the August 16 issue of the ELECTRICAL WORLD is an account of a new and quite original method of protection used on the Wallenpaupack line. Two forty-foot wooden poles have been erected on the top of each line tower to support ground wires. These are to catch and divert direct lightning strokes to ground before the discharge reaches the line conductors. This interesting experimental installation will be watched carefully by the industry. It may point toward a caged or protected transmission line as desirable in some instances, even though the structural features be changed greatly. Many different steel-structure designs can be made to carry line conductors and lightning-protecting conductors in a minimum space to better advantage than using the present design of steel tower, conductor and ground-wire arrangements. Even the conductor can be changed to conform to the shielded principle.

But before radical changes are made it is necessary to be sure that this complete protection is needed and that protection is had. This is the constructive object of the Wallenpaupack installation.

Business on Up-Grade

BOTH economic facts and expert opinions warrant the conclusion that the worst of the business depression is over and that a slow but sure improvement in business activity may be expected. Moreover, confidential reports to the ELECTRICAL WORLD from utility executives in all parts of the country are almost unanimous in stating that the worst is over and that business is picking up slowly.

Earnings and sales of utilities for the past year again show the stability of the industry and the enterprise of its leaders under unfavorable conditions. Despite heavy decreases in power sales, an aggressive selling campaign for commercial and domestic business has brought gross and net revenues to values equal to or better than those of 1929. The utilities have spent and are spending budgeted money for generating and transmission facilities to be ready for renewed power demands and have increased greatly the volume of appliance sales. They have not economized by omitting to sell aggressively, and their balance sheets show the result of this policy.

About the best evidence of the stability of the utility industry is its credit position. Despite the market slump, senior utility securities have been in demand all year, and common stocks, as shown in this issue, are maintaining values that give the lowest yields of any group of stocks on the New

York Exchange. There is little doubt that the turn toward greater business activity will create even more prosperity in an industry that has gone through a period of depression with flying colors.

A Challenge to Power Companies on Merchandising Policies

LAST week's national convention of the contractors and dealers of the electrical industry was different from those that have gone before. This difference was discernible not so much in attendance or in program as in the spirit of the occasion. The president of the National Electrical Manufacturers' Association appeared before the meeting and discussed motor resales with some frank statements on the mutual responsibilities involved. And the association passed an equally frank resolution on the subject of distribution. A vice-president of the National Electric Light Association also addressed the assemblage and frankly answered ten questions on merchandising policy which had been propounded by the Electragists. He answered them so skillfully that when he was through the audience rose and applauded. But the association nevertheless passed a resolution condemning the merchandising practices of certain power companies and calling for an investigation. To a close observer there seemed to be an atmosphere of confident purpose in this convention that has not been so conspicuously shown in recent years by this—so often called—weaker branch of the electrical industry.

On what was this confidence founded? Probably two things. During the last year or so the Association of Electragists International has been successful in organizing about seventy chapters of the contractors and dealers of as many districts, and it apparently feels that it is now in position for a more energetic program. Moreover, one of the chapters in southern California has recently made a report on competitive practices in power-company merchandising affecting that territory, and this report embodies a distinct challenge to utilities which have not yet worked out a harmonious trade relationship with local dealers.

It is perhaps for the good of the industry that this whole question of what is right and wrong in power-company merchandising policy be brought to an issue. It involves not alone the electrical dealers, who are naturally sympathetic with the traditions of electrical progress, but the hardware, drug and department stores, which are concerned only with fair play in the marketplace. Dissension between the power companies and the retailers and installers of electrical appliances, therefore, becomes a serious menace to the good will enjoyed by the public utilities in the region concerned.

It is, of course, lamentable that there should be an issue between the power companies and so many merchants whose hearty co-operation is much needed and desired. The N.E.L.A. several years ago sponsored a joint declaration of merchandising principles that was a fine move for harmony. Too many utilities and too many dealers, however, have failed to conform to these principles. It is worth a very serious effort to bring about a practical co-ordination now. This is no time for a family fight.

Lighting for Sports Service

THE sports pattern is changing. In one direction minor league baseball franchises have been abandoned; in another direction miniature golf courses are increased so fast as to rob the mushroom of its laurels. The American pendulum seems to be swinging away from mass attendance at contests where the spectators get the thrills and the players get the exercise toward sports where there is more individual participation in both thrills and exercise.

Organized sport in certain fields seems to be suffering from this new individualism. But wherever the promoters of baseball or other team contests need to schedule some of their games in the evening hours to recover their volume of attendance they may be assured that the electrical industry is prepared to render the requisite lighting service. Excellent results have been attained at many fields and arenas, and new ideas and layouts are constantly being devised to meet special situations and better results in stereotyped cases.

Thus electric lighting, while taking no side in any contest between old and new forms of recreation, is prepared to lengthen the sports day alike

for tennis, swimming and golf (either the acre or square-yard variety), and also, if its aid be requisitioned, for baseball and football.

Electric Conductivity and Dielectric Loss

THE ultimate nature of dielectric loss continues as one of the most stimulating problems of contemporary electrical research. Obviously a question of great theoretical interest and of vast practical importance, it is rarely that an issue of any electrical journal devoted to research does not present new results bearing more or less directly on the losses in dielectrics and insulation.

We have long since left the stage in which these losses were, by analogy to those in magnetic materials, vaguely attributed to some type of dielectric hysteresis. This conception was soon found to be impossible in view of the absence of consistent empirical laws of dielectric behavior. There is still some adherence to this type of explanation in the suggestion that dielectric loss is due to the oscillation of polarized molecules in a viscous medium. This idea receives its principal support in the fact that there is sound theoretical basis for such a type of loss in the higher range of frequencies—say, above 20,000 cycles. In the lower frequency range, however, the suggestion remains as only qualitative and without adequate experimental support.

The mass of recent work is pointing more and more to two well-recognized types of loss. Moreover, there is much evidence that these two are fundamentally the same and that the large proportion of dielectric loss is of the nature of the straight passage of current by electric conduction. In solids and in very compact well-dried composite materials the loss is completely explained by the phenomenon of dielectric absorption, which is almost certainly ultimately due to non-uniform conductivity. In the best commercial insulating liquids it has been shown that the loss is entirely accounted for by conductivity, if the latter be measured at a sufficiently short interval, say, a fraction of the alternating period. This value in general is quite different from that measured at, say, one minute or after a long time. In intermediate types of composite and flexible materials both types of loss may be present.

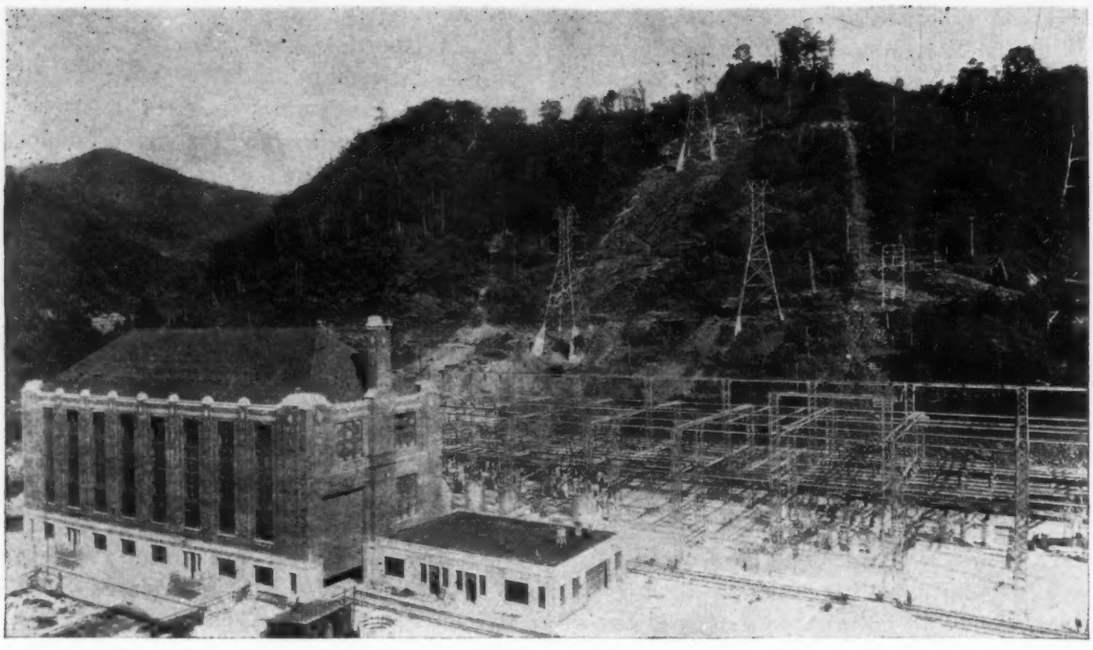
The immediate object of present research is the nature of the carriers involved in the conductivity of the dielectrics of practice. The problem is highly complex owing to the indefinite chemical structure of most of these materials. Great progress has already been made, however, and with the ever-increasing number of chemists, physicists and engineers engaged even more rapid improvement in our knowledge and control of insulation may confidently be expected.

British for Uniform Rate

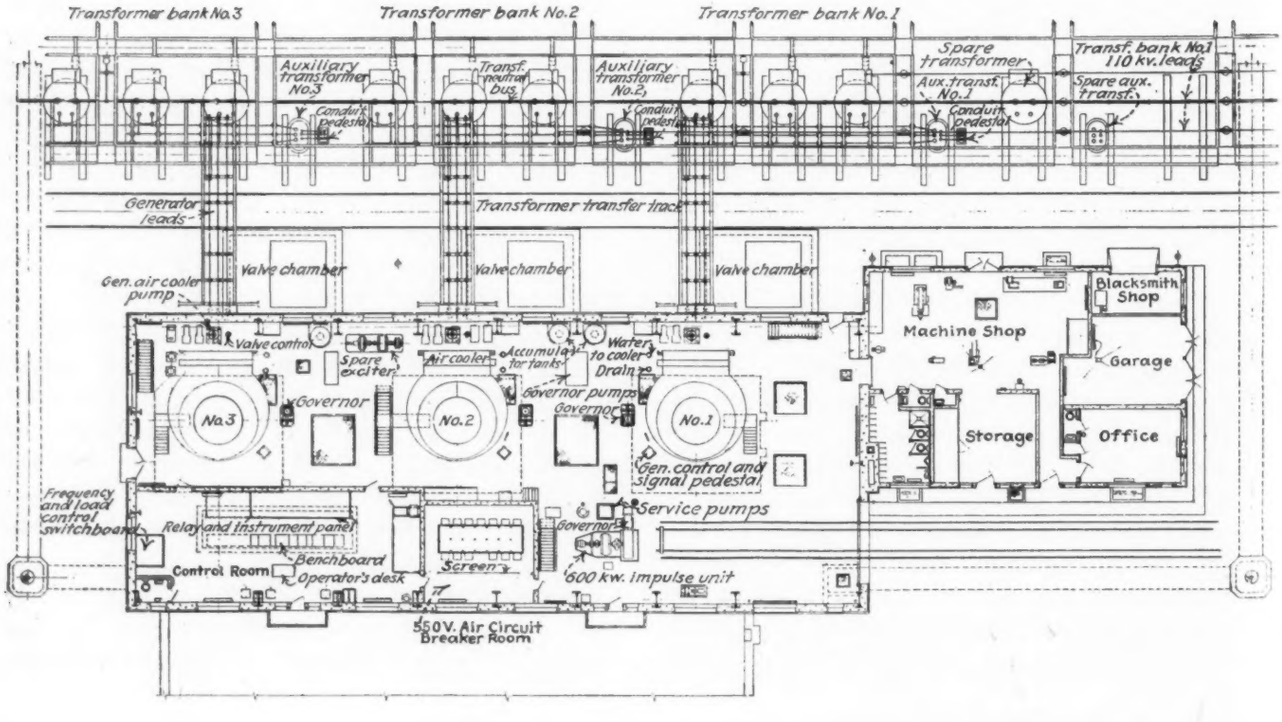
DOMESTIC rates in Great Britain are very diverse, and a committee of the electricity commission, after studying the problem, recommends a uniform rate. This rate would be based on a fixed charge determined by the size of the home and a multi-part rate or inducement rate for energy. The fixed or service charge would be paid on a weekly, monthly or quarterly basis. It is suggested that the uniform rate be made statutory as it is important to give it the stamp of authority and to include inducement features to attract the consumers.

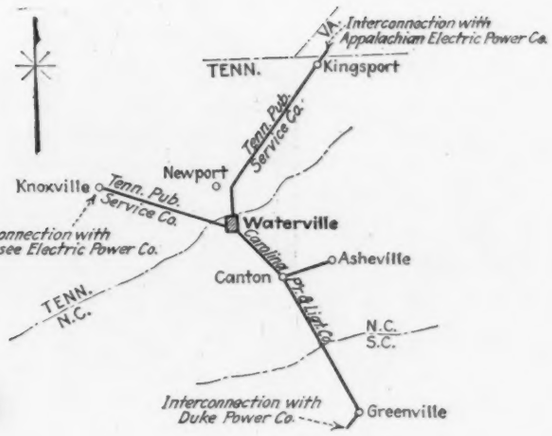
It is also interesting to note that a study of the rural service problem led to the conclusion that intensive or full use of electric service is necessary to keep the capital charges from being prohibitive. A further suggestion is that electrical apparatus be rented to consumers.

Thus Great Britain faces the same rate and sales problems as are encountered in the United States and proposes a type of solution advocated for this country. In some manner capital charges must be collected; in some manner inducement rates must be given. Of course, the use of size of house as a measure of service charge is inequitable; but similar objections can be applied to other schemes such as area, room, outlet, tax value or meter. It should be realized, however, that the collection of capital costs and service charges must be made simple, inexpensive and practical in application and that it would be difficult and impracticable to apply a method that was entirely equitable. Measured in business terms, the simplest and cheapest service charge is a meter charge.



The 108,000-kw. Waterville plant of the Carolina Power & Light Company in western North Carolina has several unusually interesting engineering features and is the hub of an interconnection between several large power systems





Short lines make Waterville the hub of interconnected systems

Waterville Hydro Makes Possible Notable Interconnection

By A. C. CLOGHER

Hydraulic Engineer
Electric Bond & Share Company

CONSTRUCTED primarily to supply the Carolina Power & Light Company's growing load centering around Asheville, N. C., the location of the Waterville hydro plant made it possible by means of comparatively short transmission lines to connect it indirectly, through lines of the Tennessee Public Service Company, to the Appalachian Electric Power Company's system in Virginia and to the Tennessee Electric Power Company's system in southeastern Tennessee and directly to the Duke Power Company's system in South Carolina.

Carolina Power & Light Company's system is made up of two separate divisions. The larger or eastern portion is located in eastern North and South Carolina and extends from the North Carolina-Virginia state line southward about 200 miles through a broad belt which in places is more than 100 miles wide. The company's total installed generating capacity is 145,050 kw., exclusive of the Waterville plant, of which the eastern division has 126,550 kw. Its principal generating stations are the Norwood hydro-electric plant, 62,000 kw., which was placed in operation in 1928; the Blewetts hydro-electric plant, 24,000 kw., both of which are located on the Yadkin River, and the Cape Fear steam-electric station, 30,000 kw., which is located near Moncure, N. C.

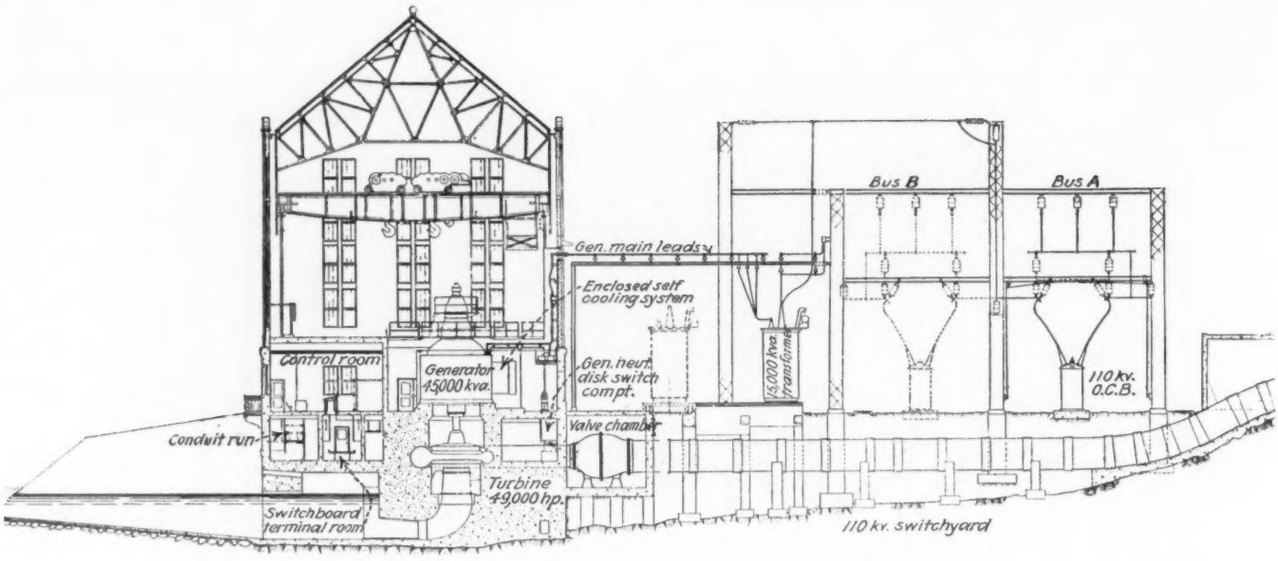
The smaller or western portion centers around Asheville and has only 18,500 kw. capacity, exclusive of Waterville, but the interconnection of both divisions of he system with the Duke Power Company on the north makes possible the use of power from Waterville, in the eastern division of the system. These and other interconnections, together with existing power contracts, justified the immediate installation of the ultimate capacity of the Waterville plant—108,000 kw.

Six-mile tunnel and single-arch dam

The head is obtained by a dam 180 ft. high and by a 6-mile tunnel by-passing 12 miles of the Pigeon River, in which there is a fall of 681 ft., making the gross head developed 861 ft., an unusually high head for a hydro-electric plant east of the Mississippi River.

The cross-section of the canyon at the dam site shows a width approximately 300 ft. at the river level and 700 ft. at the crest of the dam. The side slopes are similar and nearly uniform and a favorable stratification of the rock made an almost ideal situation for a single-arch dam. The single-arch dam was adopted and was designed by means of Cain's formula for a maximum concrete stress of 600 lb. per square inch.

No side channels were available and consequently the center portion of the dam itself was equipped with Tainter gates and utilized for passing the floodwaters over the



Generator leads connect directly with outdoor transformers

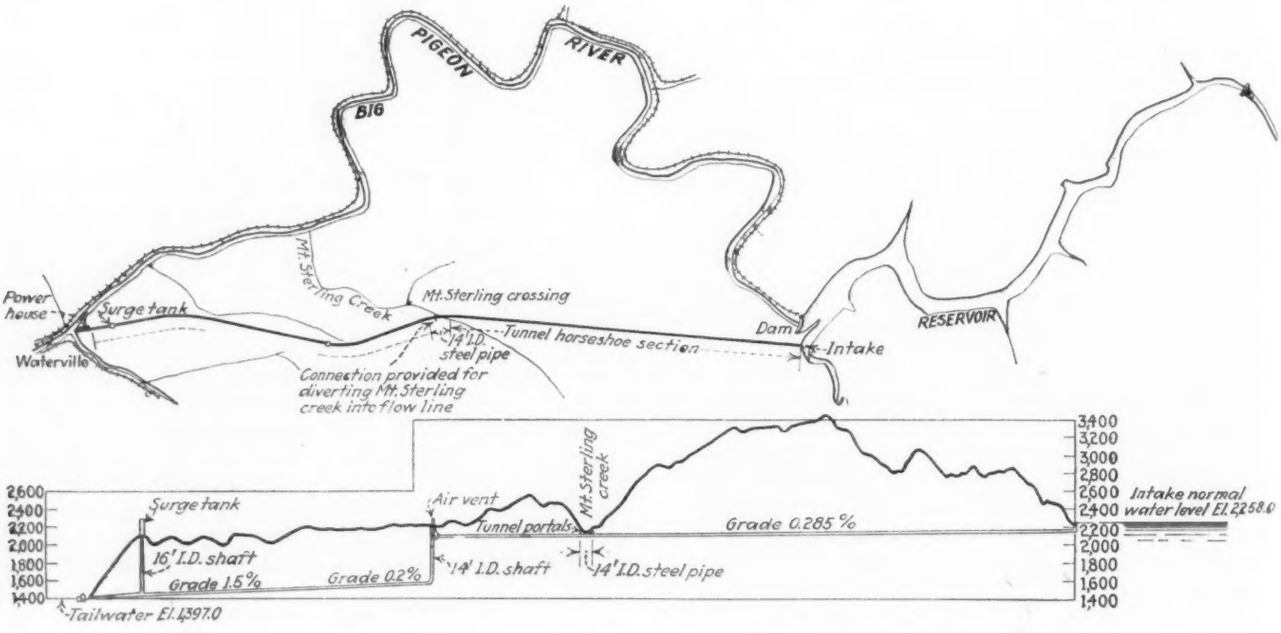
dam. The possibility of damage to the rock formation in the river channel immediately below the dam by the falling water has been successfully prevented by protecting this formation with a thick mat of concrete, onto which the water is discharged.

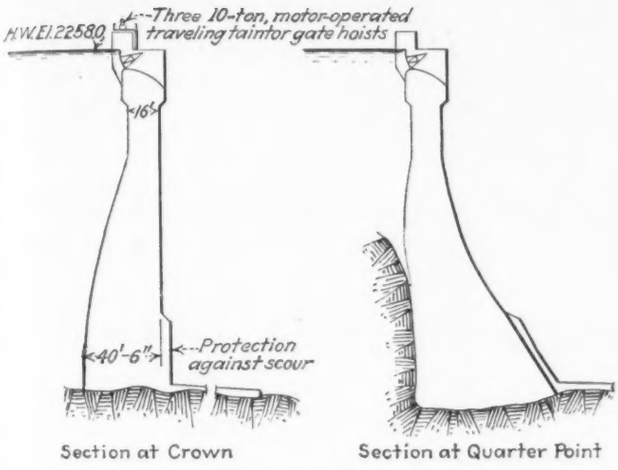
The dam was built in sections 48 ft. long with 8-ft. spaces or slots left between these sections until all of the 48-ft. sections were completed to the top. This was done for two reasons: First, a large flood discharge capacity was made available during construction, and, second, the 48-ft. sections of the dam were constructed in the summer and fall and allowed to cool throughout the following winter before the 8-ft. slots were filled with concrete in the spring.

The 8-ft. slots were filled to the top of the dam, leaving nine openings at river level 10 ft. wide and 20 ft. high. During low water seven of these openings were filled with concrete by diverting the water with small cofferdams. The last two openings were closed by means of steel flap gates capable of withstanding the full head and then filled with concrete as soon thereafter as possible.

Notable in the construction of this dam was the small amount of plant used and the unusual method employed

Flow line between intake and Waterville plant





Typical sections through single-arch dam

for placing the concrete. The specifications provided that all concrete must be placed by means of bottom dump buckets and that the derrick must be able to swing a bucket into all corners of the form.

Excepting about 150 ft. at each end all of the concrete was placed by means of two electrically operated Wiley whirleys, one operating about 100 ft. above the river bed and the other on the top of the dam. Each whirley was started on the right bank and built the next section toward the left bank up to its own level. The whirley was then moved out on to the section just constructed and built the next section toward the left bank. In this way, with the lower whirley just ahead of the upper one, both whirleys moved from the right to the left bank, placing all of the concrete in the 48-ft. sections. For filling the 8-ft. slots both whirleys were utilized on the top of the dams.

Concrete was manufactured on the right bank, under the railroad and quarry and about 400 ft. downstream from the abutment. The cars from the mixing plant reached the dam about 100 ft. above the river level, and at this elevation a track, bracketed onto the downstream face of the dam, made it possible to transport the concrete cars out to the upper whirley. The lower whirley was served by a second track located on a trestle at the downstream toe of the dam. Concrete was shot through a chute from the upper to lower level tracks into a hopper from which buckets on the lower level track were loaded.

An electrically driven guy derrick was set up at each end of the dam for use in excavating the side slopes of the canyon and for placing the concrete at the extreme ends of the dam.

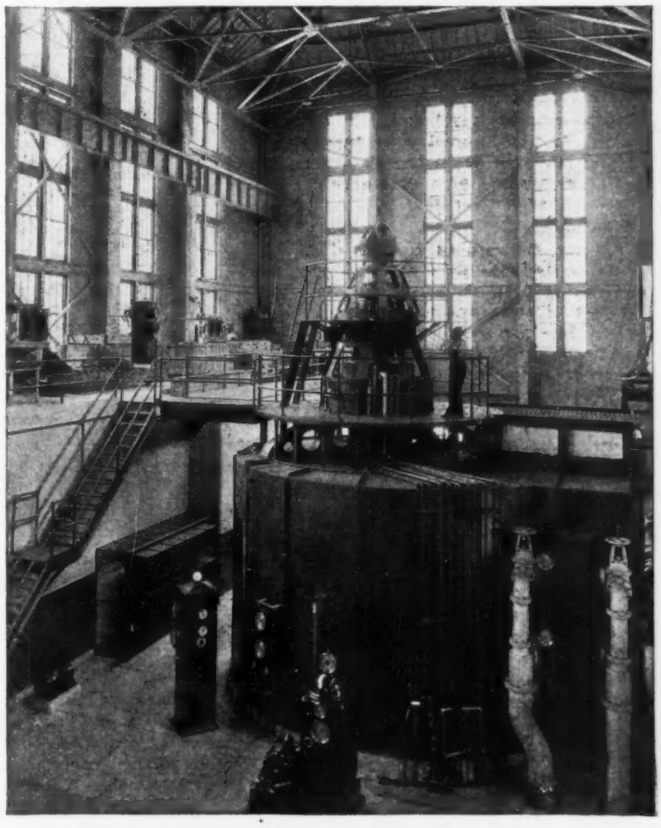
High-pressure tunnel used

The flow line consists of a tunnel approximately 6 miles long, the upper 4 miles of which was necessary as the only means practicable for conducting the water past the rugged canyon walls immediately below the dam. The lower end of the line was first planned as a wood stave pipe, with steel penstocks between the surge tank and power house, and the topography was favorable for such construction. The favorable bids on the tunnel construction and the unusually favorable geological formation induced a decision in favor of a high-pressure tunnel at the lower end of the flow line. The tunnel appeared to be slightly cheaper and a far more permanent type of construction.

Avoiding leakage through disintegrated rock

The material through which the tunnel is excavated consists of gritty phyllites and fine-grained arkosic quartzites. This material is known locally as "arkose." While it varied considerably in hardness and stratification, no other material was encountered except at the ground surface at the shafts. Practically no water was encountered in the tunnel excepting in the upper part of the Gap shaft, where a considerable depth of the arkose was disintegrated under a layer of porous material. The arkose broke out favorably, and while the specifications allowed a minimum thickness of lining of 4 in., the average thickness for the whole tunnel, as evidenced by the concrete used, was 15 in.

When the tunnel was filled the only evidence of leakage was at the base of the surge tank. The rock under the base of the tank was somewhat disintegrated and gradually became harder and more compact at increasing depths. It was thought that by lining the shaft under the tank for a depth of 112 ft. the formation below the liner would be watertight. On emptying the shaft an inspection of the ground water leaking back into the shaft showed that the leakage was occurring in the first 25 to 50 ft. below the liner. Three rows of radial holes were drilled into the surrounding rock and grouted under the head from the base of the tank. Three rings



One of the 36,000-kw. generator units

of thirteen vertical holes each were then drilled around the base of the tank. They extended downward to an elevation 100 ft. below the bottom of the shaft liner. These holes were grouted under a pressure, at ground level, of approximately 90 lb. per square inch. This grouting took about five weeks, and on refilling the ground appeared to be practically watertight.

An exceedingly interesting problem presented itself in the question of how far into the ground the penstock tunnels should extend and what the steel lining or reinforcing should be at varying depths of cover. The plan provided for terminating the 14-ft. diameter horseshoe-shaped tunnel 850 ft. from the portals back of the power house; the extension of the tunnel for 200 ft., circular in shape; a wye 50 ft. long for distributing the water into three penstock tunnels, and three penstock tunnels lined with plate steel pipes capable of withstanding the full static head and pressure rise, these

Hydraulic and Electrical Details of Waterville Hydro Plant

Location

Power house at the junction of Pigeon River and Big Creek, approximately 18 miles southeast of Newport, Tenn. Dam on Pigeon River, approximately 12 miles upstream from power house.

Reservoir

Area at elevation 2,253, 340 acres (reservoir full). Capacity down to elevation 2,175, 20,500 acre-feet (maximum drawdown). Clearing 210 acres.

Dam

Concrete arch dam about 900 ft. long on arc at top; maximum height to crest 180 ft.; top thickness of spillway 22 ft.; top thickness below spillway 16 ft., bottom thickness 40½ ft. The dam is of the variable radius type, the radius of the upstream face of the arches decreasing from 245 ft. at the top to 220 ft. at the bottom; the downstream face approximately vertical at the crown; the angle between the ends of the arches varies from 126 deg. at top to 109 deg. at bottom. 124,200 cu.yd. concrete in dam.

Spillway

Formed at center of arch dam by ogee section overhanging upstream and downstream faces of dam 3 ft.; equipped with fourteen steel Tainter gates 24 ft. long by 10 ft. high, operated by three movable, motor-operated drum type hoists (one provided with gas engine auxiliary); discharge capacity 60,000 sec.-ft.

Apron

Water discharging from the gates falls free of the dam on a concrete mat apron, averaging 5 ft. thick, placed on solid rock in bed of river and extending downstream from face of dam 70 ft., constructed in sections 56 ft. wide, without reinforcing, excepting one section.

Permanent By-Pass

5 ft. diameter with concrete screens and steel flap gate at entrance. Discharge controlled by a Johnson free discharge valve on downstream face of dam. Sluiceway located low enough to unwater intake to flow line, lined with extra heavy cast-iron pipe.

Intake

Reinforced concrete structure 120 ft. high with structural steel screen guides, supporting intake gate hoist and permanent steel derrick for handling screens. Screens, 24 panels 5 ft. 4 in. x 16 ft. with 3-in. x ⅝-in. bars spaced on 1¾-in. centers; compressed air equipment for cleaning screens. Discharge into tunnel flow line controlled by steel gate with fixed rollers, total weight 91 tons; closes opening 14 ft. 8½ in. by 12 ft. 6 in.; structural steel riveted and welded, filled with pig iron and concrete; lifted by electrically operated twin screw stem hoist of 450 ton capacity, closed by its own weight.

Flow Line

Tunnel 32,715 ft. long, horseshoe shaped, 158 sq.ft. net area. Concrete lined, average 2.3 yd. per foot equals 15 in. thick. Minimum thickness allowed 4 in. (tunnel unreinforced except near ends). Grades 2.85 ft., 2.0 ft. and 15.0 ft. per 1,000 ft. Adits—three, two at Mount Sterling Creek and one at Gap shaft. Velocity at full load 11.3 ft. per second. Steel pipe across Mount Sterling Creek 14 ft. in diameter has 24-in. flange for future connection and diversion of creek into tunnel.

Surge Tank

Johnson differential type, supported directly on concrete foundation; height, 195 ft.; diameter, 42 ft.; riser, 10 ft. diameter; overflow, varying from 8 ft. 3 in. diameter at top to 4 ft. 6 in. at bottom. Top elevation 19 ft. above reservoir level; will handle surge for full capacity of the station, 108,000 kw. on or off, in four seconds; maximum thickness of side plate 2 in.

Wye

The horseshoe tunnel is followed by 200 ft. of 14 ft. diameter circular section leading into the concrete wye 50 ft. long and located 600 ft. from portals. Minimum thickness of concrete in circular section, 6 in.; in wye, 1 ft. 6 in. From the wye three tunnels extend to portals directly behind the power plant.

Penstocks

Three penstocks, one for each unit, riveted steel plate 8 ft. in diameter for 605 ft. in length from wye to tunnel portal and butterfly valve. From butterfly valve to Johnson valve at power house 175 ft. riveted steel 7 ft. in diameter. Plate thickness varies from 1 13/32 in. to 2 1/16 in.

Penstock Valves

Two on each penstock; at tunnel portal a 9-ft. inlet by 7-ft. outlet diameter butterfly operated by water from penstock with compressed air provided for emergency closing; at power house, a 7-ft. inlet by 5-ft. outlet diameter Johnson valve provided with electric motor and Pelton waterwheel for quick opening; remotely controlled from switchboard and from pedestal near generator; maximum head, including surge, 1,280.5 ft.

Turbines

Three S. Morgan Smith Company vertical reaction rated at 49,000 hp. at 755 ft. head, 400 r.p.m.; cast-steel scroll case; bronze one-piece runner; one guide bearing oil lubricated; S. Morgan Smith Company governors, oil pressure actuated, designed to make full stroke in four seconds. No pressure regulator.

Generators

Three Westinghouse Electric & Manufacturing Company, rated 45,000 kva., 0.8 power factor, three-phase, 60 cycle, 13,800 volt. Generators are of the conventional type, having upper and lower guide bearings. Thrust bearing is a water-cooled, 48-in. Kingsbury type designed for rotating load of 510,000 lb. and is supported from a spider-shaped cast-steel upper bearing bracket; WR^2 = 3,850,000 lb.-ft.^{2}. Each generator is equipped with brakes, lifting jacks and fire extinguisher coils.

Inclosed recirculating system of ventilation with Griscom-Russell surface air coolers using water pumped from tailrace. Air enters generators at both top and bottom, discharging through sides into steel duct containing air coolers mounted vertically in two sections located at one side of generator.

Exciters

Three Westinghouse, direct connected to main generators; capacity 185 kw., 250 volt, shunt-wound, quick-response type, separately excited by 10-kw., 250-volt pilot exciter. One Westinghouse spare motor-driven exciter of capacity sufficient for one unit, 200-kw., 250-volt, shunt-wound, quick-response type, separately excited by 5-kw., 250-volt pilot exciter.

Main transformers

Ten General Electric, 15,000 kva., water cooled, single phase, 60 cycle, 13,200 volt delta-66,400/115,000 Y volts, arranged in three banks of 45,000 kva. each with one spare.

High-Voltage Switching Equipment

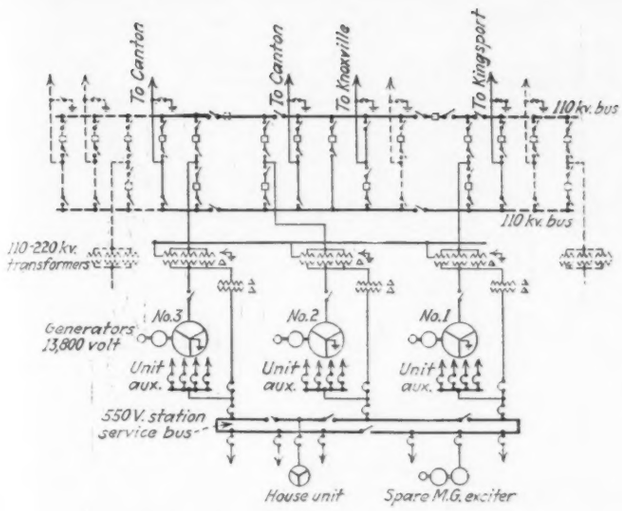
Twelve General Electric outdoor type 110-kw., 6,000-amp., motor-operated oil circuit breakers, interrupting capacity 1,000,000 kva.

Switchboard

General Electric Company benchboard type with vertical instrument and relay panels; I. P. Morris automatic frequency and load control equipment.

Auxiliary Power Supply

One S. Morgan Smith Company house service unit, consisting of 850 hp. at 734.5-ft. head horizontal shaft impulse turbine, direct connected to Westinghouse Electric & Manufacturing Company 600-kw., 575-volt generator with direct-connected 14-kw., 125-volt exciter. Four General Electric Company 750-kva., self-cooled transformers, three phase, 13,800 volt delta-575 volt delta, one transformer connected to the leads of each generator and one spare; one I-T-E Circuit Breaker Company switchboard for auxiliaries equipped with solenoid-operated air circuit breakers installed in separate room.



Simple but flexible switching

steel pipes to be back-filled against the tunnel with concrete. No reduction in the amount of steel required was made on account of the increasing amount of cover away from the portals. The circular tunnel and the wye were provided with an extra thickness of concrete lining to allow for extra heavy grouting. The minimum cover on the lower end of the wye, where the steel penstock lining commenced, was 350 ft., practically all rock.

Features of the station

Some features of the station design are of special interest. The power house superstructure is of the conventional type and is equipped with one 150-ton two-trolley crane. A steam heating system is installed, as the plant is designed for operation at low load factors and will have long shut-downs at night and over week-ends and holidays.

As one means of maintaining electrical stability on the interconnected system each generator is individually equipped with quick-response excitation, consisting of a direct-connected main exciter with pilot exciter and an exciter rheostatic type voltage regulator, including a positive phase sequence network.

The generators have amortisseur windings and are designed for operation as synchronous condensers. To permit the unit instantly to carry load in the event of a sudden demand, when operating as a condenser with small water pressure in the turbine casing, there has been provided a special Pelton waterwheel so arranged as to open the Johnson valve half way in six to eight seconds.

The essential motor-driven auxiliaries for each generating unit, consisting of the governor oil pump, the cooling water supply pump and the lubricating oil pumps, are supplied from a unit auxiliary bus, fed either from the 550-volt station service ring bus or from any one of the station service transformers connected to the generator main leads. Each generating unit, turbine and generator is equipped with a central lubricating system which supplies oil to the bearings by means of a motor-driven pump, with a duplicate pump as a standby.

The leads of each generator, partly of copper bar and partly of 3-in. copper tube, make a solid connection to a unit, delta-Y, step-up transformer bank, with the high-voltage neutral solidly grounded. The generators are switched directly into the 110-kv. double buses by oil circuit breakers installed in the 110-kv. transformer leads. Synchronizing is accomplished by bushing type potential devices on the 110-kv. oil circuit breakers.

The 110-kv. switchyard is designed to provide for four outgoing lines initially and eight ultimately and also makes provision for the possible future installation of 220-kv. transformers and lines.

The control room, which is constructed as nearly soundproof as practicable, is located on the main operating floor on the tailrace side of the building. A Selsyn signaling system provides the means of communication between the control room and generator room as the operating area around the units cannot be seen by the switchboard operator. An annunciator is provided to indicate the operation of temperature alarms for generators and transformers and feeder breaker operation.

In addition to the usual control benchboard and instrument panels, automatic frequency and load control equipment is installed. This automatic equipment is the second installation of its kind, the first one being in use in the Norwood plant of the same operating company. The equipment is designed to control automatically (1) independent constant load on each unit, (2) constant station load with economic load distribution on two or more units operating in parallel, (3) frequency regulation on any one unit with the remaining units in service operating on controlled load independent of the frequency-regulating unit, but available to assist in the regulation of freqnency if the demand varies above or below the capacity of the regulating unit, (4) frequency regulation on any or all units simultaneously with economic load distribution between units.

The plant was constructed for the Carolina Power & Light Company by the Phoenix Utility Company, of which H. F. Lincoln is construction superintendent. It was designed by the engineering department of the Electric Bond & Share Company.

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Waterwheel Losses Reduced

IT HAS been observed that the losses involved in operating waterwheels as synchronous condensers may be as great as 25 per cent when water fills the draft tube and runner, or of the order of 5 per cent when the draft tube and runner contain air. An air chamber may be formed by openings in the wheel pit or by forcing air into the runner under pressure. In one instance of the use of a waterwheel for a synchronous condenser, according to C. F. Merriam, Pennsylvania Water & Power Company, 5,000 kw. was consumed when water was in the runner, whereas only 400 kw. was consumed with air in the runner.

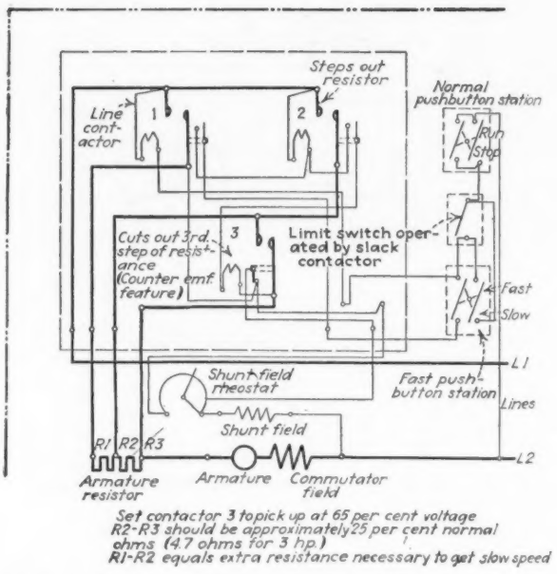
Pitting in waterwheels may be effectively stopped, it is said, by the use of pitting plates attached to the runners. Such plates, $\frac{3}{4}$ in. thick at the trailing edge and zero at the top, extending to about 3 in. below the pitted area, have been successful in experimental work.

Synchronized Motor Operations Improve Linoleum Production

TO ELIMINATE spoilage due to tearing, rubbing of moist design surfaces and uneven pulling in the Trenton, N. J., print mill of the W. & J. Sloane Manufacturing Company the engineers of the General Electric Company, working with those of W. & J. Sloane, devised a motor-synchronizing scheme which has minimized many production difficulties.

Linoleum, in sheets 2, 3 and 4 yd. wide and approximately 180 ft. long, is fed from rolls through the printing machine which imparts the many-colored design upon it. This is done by a number of blocks which are impressed on the linoleum surface successively so that the feed through the printing machine is not continuous, but one of many successive starts and stops. From the printing machine the linoleum is drawn upon long horizontal full-length racks for drying and aging. To draw the sheet rolls from the press to the racks a cable and hook are provided and a 6-hp. motor at the far end of the racks offers the power to operate a three-drum winch. The problem was that of synchronizing the winch motor with that of the press feed. If the slack becomes too great or too little either rubbed colors or twisted or torn sheets will result. Formerly hand control was used.

As shown in the accompanying illustration, a contact arm, which rolls along the slack of the sheets between press and racks, is the operating medium now employed.



Contact arm and two push-button stations control difficult production problem

Upper push-button station is for normal operation of sheet linoleum racking device. Lower station speeds up threading preliminary to racking. Contact arm controls racking motor speed.

Too much slack speeds up the motor, too little stops it instantly. According to J. E. Richford, electrical engineer with W. & J. Sloane, this arrangement is working satisfactorily. The inclusion of a "fast" running button facilitates the threading of the cable before drawing the sheets.

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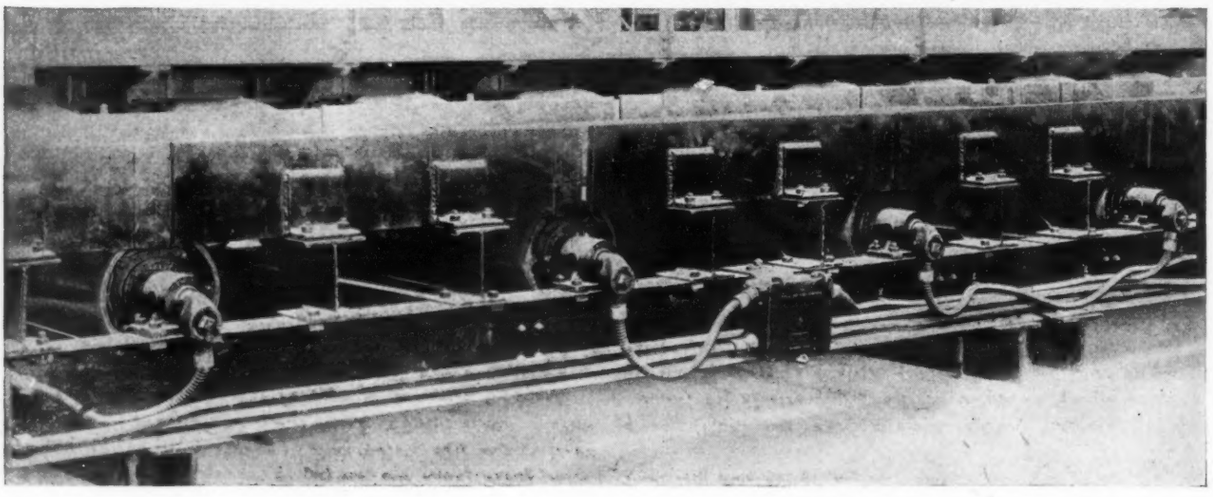
Transfer Table Rolls Individually Driven

Each roll of the transfer tables in the Massena structural steel mill of the Aluminum Company of America is driven by a separate motor, the roll constituting the rotating element of the motor. While this drive is more expensive than group drive, it is employed because the friction load is reduced, the rolls will run freely without power, maintenance is minimized and failure of one or several rolls will not interrupt use of the train.



Can the Architect and Engineer Work Together?

By EARL WHITEHORNE

Contributing Editor of ELECTRICAL WORLD

THIS much-needed and sometimes elusive co-operation about which we hear so much nowadays was discussed recently by Earl Whitehorne at a joint conference of architects and engineers held at the Westinghouse Lighting Institute. As he points out, merely saying "Let there be co-operation" will not establish co-operation. It requires a mutual understanding of each other's problems, ambitions, ideals, weaknesses and strength. More than this, it requires a mutual interest. These essential elements of co-operation were given tangible concrete form by considering architects and engineers as individuals.

WHILE the comments apply specifically to architects and engineers, they give a vivid picture of how approach to any problem can be made more successfully whether it involves loosely affiliated groups, groups within an industry, or individuals within a single company or department.

WHY is it difficult for the architect and illuminating engineer to co-operate? And why should they? And what must they do in order to develop a co-operation?

The architect is an artist above all. He lives in a realm of beauty of form; he is tremendously interested in the artistic side of a building. The fact that he is obliged to deal with such crude elements as mortar and brick and steel and pipes and wires is a continual source of distress and exasperation to him. It is one of the inescapable impediments to the free-flowing artistic spirit that he delights in. For the architect is an artist, a man of warm temperament. And when he dreams, he dreams of beauty.

But the illuminating engineer is an entirely different kind of person. He is practical, an engineer, a man of science. He too is temperamental in a way, but it isn't the warm temperament of the artist; it is the colder temperament of the scientist. He lives in a world of technique. If he can't play it on a slide rule it isn't music. He is bound round with the traditions of his engineering background. His attitude toward things is precise.

Yet, both these men, different as they are in their approach to this subject, are essential to the development of architecture. For unless the artist can dream his dream and then reduce it to realities, unless he can draw his plans and carry out his project in terms of the materials of construction, he achieves nothing. And unless the engineer can take the artistic conception and work that into the fabrication of his materials, he has contributed nothing to the beauty of the world or to human enjoyment beyond the bare materialistic.

And so we have in architecture and in building construction these two concerns—that of the architect and that of the illuminating engineer. Also it is an interesting thing to consider how necessary these two individuals are to each other, not only in their work, but in their thinking.

The architect needs the aid of engineering thinking. For at the present time the architect also is a slave to technique. He deals in certain formulas and principles which have come down to him from the classic ages. He is using the materials of the ancients. He is dealing in paint. He is dealing in sculpture. He is concerned with the fashioning of materials. And yet just as every other professional man is repressed by the very limitations of his technique, so is the architect. Who was it, by the way,

who brought about the great revolutionary changes in architecture that have impressed us so in recent years?

It wasn't an architect who changed the whole concept of cottage architecture in America not long ago. It was Edward Bok, a publisher. Edward Bok, perhaps twenty years ago, came out in the *Ladies' Home Journal* with an offer of big money prizes for the encouragement of better design in cottage architecture. He set up a competition among the men and women of America to build more beautiful homes and put an impulse behind the development of architecture in the American home that has swept away the old atrocities of the Victorian era and has made America a country of beautiful residences.

The architect was forced by the pressure of public opinion to make this revolutionary improvement. And so it was with the evolution of our wonderful big building architecture in the modern city. It wasn't an architect who conceived this great improvement either, which is turning the skyline of this city into a fairyland of massive beauty with the shapely towers of monumental buildings. It was an ordinance in the city of New York that demanded the setback construction and introduced a new note of appealing design into big building architecture. It required the impulse of a commercial purpose, of a legal restriction. Then the architect escaped from the restrictions of his precedents and traditions and has gone forward with a perfectly tremendous achievement.

Therefore, I say that the architect of today needs some of the engineer's thinking. Because, after all, the engineer has been the pioneer of progress in the last generation or two. We deal today in our progress with greater forces and greater masses, and there is greater need for scientific approach and scientific development.

Illuminating engineer needs the architect

All right, then, let's next consider the illuminating engineer. I believe he needs the thinking of the architect just as much as the architect needs a little more of the engineer's viewpoint. The illuminating engineer, like other electrical people, is a slave to the slide rule. He is absorbed in his technique. But he must escape from it. He must begin to appreciate that it is not the mere fabrication of a lot of materials that is worth while, but expression through that fabrication of some contribution to human happiness and comfort and progress. I think he must lay aside his lumens and his watts to a very considerable extent and begin to recognize that in modern buildings comfort, beauty and facilities for service and the important objectives. The watts and the lumens and the wire and brass tubing and the other material elements of his work are, after all, just a means toward a very desirable end.

After all, what is it all about—this architecture and this illuminating engineering? We are living in a new world, in an era of comfort and beauty. But modern comfort and modern luxury are very different from the conception of a few centuries ago. In the days of Greece and Rome and Egypt, that we look upon as the classic era of luxurious living, of what did that luxury consist? It was contributed by the presence of servants more than any other one thing. A rich man was surrounded by his slaves and his retainers who ministered to his comfort. And because they were surrounded by these ministrations, it seems to us that they lived in an environment of alluring luxury. But today we are dependent for luxury not upon servants but upon facilities for service.

We have come into an era, into a generation in which it is no longer possible to have human ministrations to any large extent. Therefore because of the increasing cost of labor and the decreasing availability of servants, we have begun to apply our ingenuity, our brains, our money and our power to developing scientific resources of service, of comfort and of luxury, to take the place of the old system.

In that way we have built for ourselves an environment more beautiful, more comfortable and more satisfying than any previous age has ever known. And the dawning recognition of the fact that beauty is within our grasp and that comfort is our right and that the enjoyment of service is only common sense is beginning to dominate the whole spirit of our civilization.

Recognize change in tempo

In large buildings, factories, offices and stores we are beginning to appreciate that the cost of labor and price of human effort is so large that anything that may be put into the environment to make for more happiness and build a spirit that will lead to better work will pay over and over again for the cost of establishing it there.

Therefore, I think we have a definite problem, we engineers, we architects, in the synchronizing of our work with the new tempo of life. We must provide for progress. We must provide not only for the present demands of this generation, but for the constantly and steadily accelerating progress which we see piling up ahead of us.

It is a new world, gentlemen, and you engineers and you architects can not isolate yourselves from it. There is no defense against progress. The new demands, the new appetites, new aspirations and new possibilities for the use and enjoyment of these facilities for service in the buildings that we occupy in our private life and in our business are piling up and piling up.

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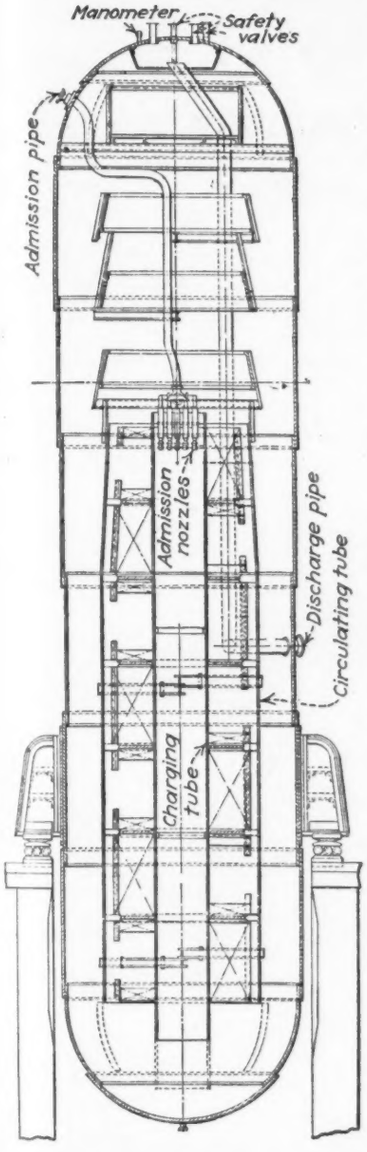
Functions of Street Lighting*

ALTHOUGH the elimination of night accidents is still one of the main functions of street lighting, there are still many other advantages. They may be briefly tabulated as follows:

1. Protection.—A great detective has made the statement that one street light is worth two policemen.
2. More business from residents.—Due primarily to night window shopping.
3. More buyers from out of town.—Attracts people from out of town and makes it inviting for them to stay over night.
4. Stronger impression of thrift and progress.
5. Better civic pride.
6. Help for the fire department.
7. Less glare from automobile headlights.
8. Promotion of other industries.
9. Increased real estate value.
10. More sanitary condition of streets.
11. Improved traffic control.
12. Fewer traffic accidents.

**From a paper by Dudley M. Diggs, General Electric Company, before a New York State conference of Mayors and other civic officials.*

Peak-Load Accumulators Supply 50,000 Kw. Demand



Recent type of steam accumulator for peak-load service

MEETING peak-load demands efficiently and at low cost is one of the most difficult problems which the central-station engineer has to solve under the present loading schedules. The use of steam accumulators for solving the problem at Charlottenburg, Germany, is described in a recent issue of *Engineering* (England). At that plant a battery of sixteen accumulators, each with a capacity of 11,036.5 cu.ft., is used. This group of accumulators is capable of storing 600 tons of steam, the heat in which will supply a momentary load of 40,000 to 50,000 kw., or allow 67,000 kw.-hr. to be generated in about 3½ hours. They are of vertical design, largely to conserve space, and approximately 15 ft. in diameter and 70 ft. in length.

The accumulators are controlled by electrically operated admission and discharge valves which bring the turbines that they supply onto the load when the demand on the 30,000-volt network exceeds a certain predetermined value and which cause the accumulator to be charged with steam from the main boilers when their pressure falls below a definite figure.

In practice one of the 20,000-kw. accumulator turbines is kept running on weekdays from 7 a.m. to 7:30 p.m. and, in conjunction with a storage battery, normally takes the morning and evening peak loads. During the former period some 18,000 kw.-hr. are supplied and during the latter about 51,000 kw.-hr. are furnished. For the remainder of the day the turbine runs on a load of about 500 kw. in order to compensate for the wattless power of the network, and for this purpose is supplied with steam from the 29.4-lb.-per-square-inch mains.

The accumulators discharge at a pressure varying between 190 lb. and 7.5 lb. per square inch into a special steam line which supplies two 20,000-kw. turbines.

When the accumulator is fully charged it is about three-fourths full of water. Charging steam is led in through an admission pipe and passes through the charging nozzles into the charging tube. When fully charged, water occupies about 93 per cent of the space in the accumulator.

During discharge the steam formed at the surface of the water rises to the top of the accumulator and passes out through the discharge pipe. Each accumulator is provided with a flange to which a manometer is connected and two safety valves are fitted. Make-up water is supplied through a cock in the lower spherical end, and the blowing down can be effected through a second cock.

The shells of the accumulators as well as the pipes are well insulated and the admission pipes are provided with expansion bends which are mounted on springs so that they are free to move upward as the shell expands.

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Reverse-Phase Relays Not Needed for Hoists

SINCE the report to the annual meeting of the electrical committee of the National Fire Protection Association a number of findings have been recorded with respect to the 1930 edition of the National Electrical Code.

Two of these are of particular concern. The first, dealing with section 1003-k, which has to do with protective equipment on elevators and cranes, was brought about by an inquiry as to whether the provisions of that section, which call for the use of approved automatic brakes or reverse-phase relays operative in the case of any phase reversal that would cause a reverse motor rotation, apply to motors driving conveyors or hoists when such motors are dependent upon phase relation for the direction of rotation. The finding is as follows:

"No. The paragraph is designed to secure a safeguard against injury to operators and passengers in freight and passenger elevators and to operators in the cabs of cranes. Its provisions do not necessarily apply to all other conditions where phase reversal would result in reverse rotation of the motor."

The second finding concerns section 1102-b, which deals with construction and mounting of transformers and is a ruling on the following question:

"Does section 1102-b refer to current transformers used for metering large services, and, if so, can approved grounded metal cabinets be used to house these transformers without a slate or insulating base?"

The finding reads: "Paragraph b of section 1102 makes no exception in the case of current transformers. The installation of transformers and capacitors in metal cabinets does not avoid the necessity for heat insulation when the installation is made upon a surface of combustible material. Sheet metal is not to be considered a non-combustible, non-absorptive insulating material."

Gas Tar as Boiler Fuel

By O. C. STOKKE
Gas Superintendent Northwestern Public Service Company, Huron, S. D.

GAS tar has been proved to be a good boiler fuel by the Northwestern Public Service Company, which operates an interconnected system that includes seven steam-generating stations in South Dakota and Nebraska. The company supplies gas service to a number of the larger towns in its territory and from the gas plants comes a large by-product of tar, the disposal of which has heretofore been a difficult problem. Because of the long distance by rail to the tar refineries and the low price received for the tar in tank-car shipments, the company has been compelled to establish a local market. This was done, and it was decided to burn tar under boilers.

It was soon decided that the most successful and efficient way to burn the tar would be through a burner specially designed for a fuel of its consistency and character. The home-made burners required considerable care and attention and, being somewhat crude in performance, caused unevenness of operation, with occasional difficulties of stoppage and objectionable smoke. Higher fuel efficiencies were needed for burning the tar profitably and an oil burner was finally secured which was a very good performer. The results obtained were exceptionally good—beyond expectations.

Experience at different power plants of the company where gas plants adjoin has been similar in the use of gas tar for fuel, but for the purpose of this article only the North Platte, Neb., situation, where two tar (oil) burners were installed, is considered. The operating principles, when using tar, were as simple as with distillate of fuel oil. Following the installation of the burner in compliance with the burner manufacturer's suggestion, the fuel was ignited quickly and a continuous run was made over a period of two weeks. The tar was burned continuously without any trouble whatever. It was surprising how steady and uniform the flow of tar was kept, with little labor or attention on the part of the boiler room firemen. Steam is used for atomizing the tar fuel. Combustion is perfect and the flame is controlled to any desired intensity and degree of volume or spread in the combustion chamber.

The boiler was operated at full load continuously and one other boiler using coal was in service only at peak hours of demand. Two to three boilers using coal for fuel had previously been operated, but when using tar under one it was found unnecessary to fire the third. Considerable over-rating was obtained from the boiler fired by gas-house tar. The tar-fired boiler is of the water tube type, built in 1915, with a low combustion chamber. The tar allowed a better utilization of the comparatively small combustion space, with consequent better boiler efficiency and the entire elimination of smoke. Gas tar has a heat content of 140,000 to 150,000 B.t.u. per gallon and as an unsalable byproduct it may be said that the only cost attached to its use is that of handling and burning. Tests at North Platte have shown a gallon of tar to be the equivalent of 11.2 lb. of coal. Since the coal is Colorado screenings of about 11,600 B.t.u. per pound, the efficiency of tar utilization appears to be quite high. It represents a distinct saving in fuel cost for generation and permits a reasonable credit to the gas department. For this reason the burning of the tar is a happy solution to the problem of its disposal and will be continued at least until conditions change and present a more profitable outlet for it.

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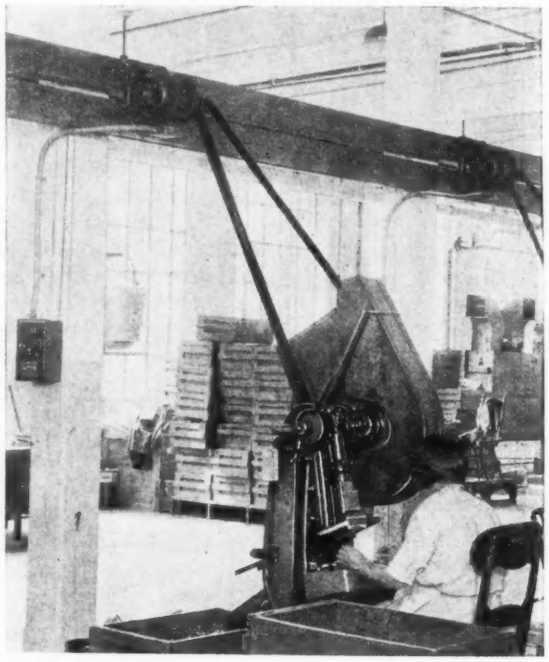
Simplified Mounting for Motor Group

A FLEXIBLE design for motor mounting in groups is in use at the new factory of the Wiremold Company, Hartford, Conn., a plant of mill type construction. In the mounting illustrated a battery of five Bliss No. 18 inclinable presses is provided with belt driving from individual 1-hp. motors. The motors are bolted to two $3\frac{1}{2}$ x $5\frac{1}{2}$-in. wooden timbers spaced 2 in. between planks and attached to the posts by $\frac{7}{8}$-in. bolts. The motor bolts are $\frac{1}{2}$ in. in diameter. The motor starters, which are of the manually operated type with thermal cut-outs and for across-the-line operation, are located on the columns and the use of both rigid and flexible conduit provides for compact and convenient feeds. In these drives the motor pulleys are 3 in. in diameter with $3\frac{1}{2}$-in. faces and the driving pulleys of the presses are 20 in. in diameter, with belt guards as shown. With this arrangement the setting up or changing of a battery of machines as to location can be completed rapidly and with no ceiling or floor drilling; the individual machines can be quickly lined up and the small amount of material required contributes to low cost.



Symmetrical mounting of motors above floor saves space and material

Relaying a Medium-Voltage A.C. Network

By J. B. POWELL
Central Station Engineering Department, General Electric Company

THE purpose of this article is to present a simple scheme for relaying a medium-voltage a.c. network as presented by D. K. Blake's article "Serving a Medium-Voltage A.C. Network," which was published in the ELECTRICAL WORLD, March 5, 1927.

Refer to Fig. 1 for the diagram of the system studied. The voltage of the network is taken at 4,000 volts. The transformers are 5,000 kva., studied first with 5 per cent and then with 10 per cent reactance. The network is No. 4/0 wire, 14½ in. flat horizontal spacing having a reactance of 0.552 ohms per mile or 17 per cent per mile on 5,000-kva. basis. The area of each block is 4 square miles, studied with the sides 2 miles by 2 miles

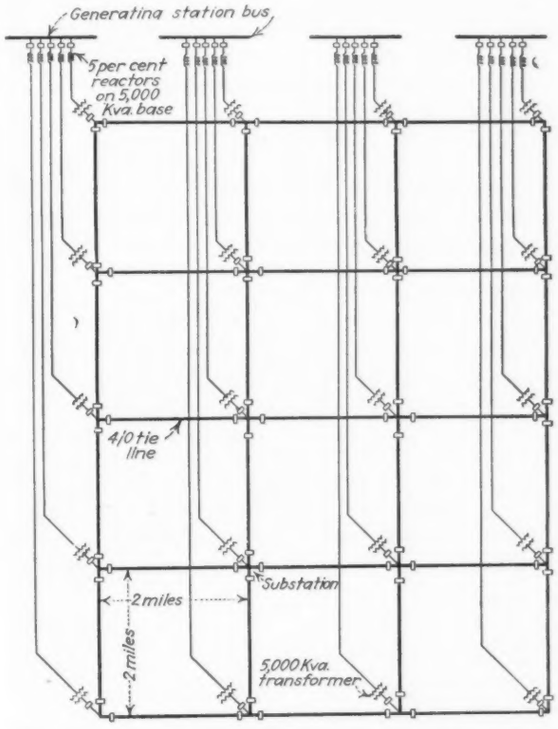


Fig. 1—Experimental set-up of relays and breakers verifies protection on 4,000-volt overhead network

or equal sides, then 1.41 miles by 2.82 miles or a 2:1 ratio, then 1.15 miles by 3.45 miles or a 3:1 ratio. The reactance of the transmission feeders was neglected, as it would be small compared with the network reactance. The reactor in each feeder is 5 per cent on a 5,000-kva. basis at 13,200 volts.

The relay study was made on a d.c. calculating table. Faults were placed on the entire system at various points under different system and operating conditions of transformer reactance, ratio of sides of the blocks in the network with all the transformers in service and with some of the transformers out of service. After all tests were made the following relay scheme and settings were chosen:

All of the network tie lines would have 400:5-amp. current transformers (based on 4,000-volt network) with overcurrent relays having a time current characteristic the same as No. 3 time-limit setting of the IA-206-Y3 relay shown in Fig. 2. All of the incoming feeders would have 800:5-amp. current transformers with reverse power relays in conjunction with overcurrent relays having a time current characteristic the same as No. 1 time-limit setting of the relay shown on Fig. 2.

By connecting all the 400:5-amp. current transformer secondaries in parallel and in parallel with a 1:2 ratio instrument transformer across the secondaries of the 800:5-amp. current transformers at each substation, it is possible to get instantaneous protection for a bus fault by using an instantaneous overcurrent relay connected across the current transformers. The outgoing feeders from the generating station would have overcurrent protection using a relay whose time current characteristic is the same as No. 5 time-limit setting of the relay shown on Fig. 2.

Only three relay settings required

In other words, the scheme proposed for relaying this type of network would involve only two types of relays, namely, reverse power and overcurrent with three different time lever settings for various parts of the system as follows:

1. One setting—high—for all outgoing feeders at generating station.
2. One setting—medium—for all the lines of the network.
3. One setting—low—used in conjunction with the reverse power relays on the incoming feeders at the substations and also for the substation bus protection, as it would give almost instantaneous operation on bus faults due to the values of current involved.

The relay system as outlined above will give positive selective operation of breakers for faults on the network and feeders except as follows:

Selectivity cannot be secured on corner sections of the network with the transformer at that corner out of service. This applies to networks having the sides of the blocks any ratio.

With the ratio of the sides of the blocks 3:1 and transformers having 5 per cent reactance, selectivity is not so positive with faults near a substation and the transformer at that substation out of service. If the reactance of the transformers is 10 per cent, the selectivity at these points is certain in most cases and very probable in the remaining few. With the ratio of the sides of the blocks 3:1 and transformers having 5 per cent reactance, a fault just outside and on the high side of the corner transformer might give faulty operation, although selectivity is very probable.

With the ratio of the sides of the blocks 3:1 a fault on the low side of the corner transformer would not give selectivity; however, if the substation layout permitted, it would be possible to so place the current transformers on the incoming feeder transformer low-voltage side so as to include all wiring between the low-voltage terminals of the transformer and the substation bus in with the bus protective scheme and thus get selectivity

for this case. Selectivity was based on a minimum limit of 0.5 second between the time required for the proper relays to operate and the time required for the relays on the good lines to operate.

This relay study was made to determine the possibility of relaying a medium-voltage a.c. network by using overcurrent relays, all with the same setting, on the network proper where the cases of possible non-selectivity are few and very remote. Most of the cases of non-selectivity will occur when the sides of the blocks have

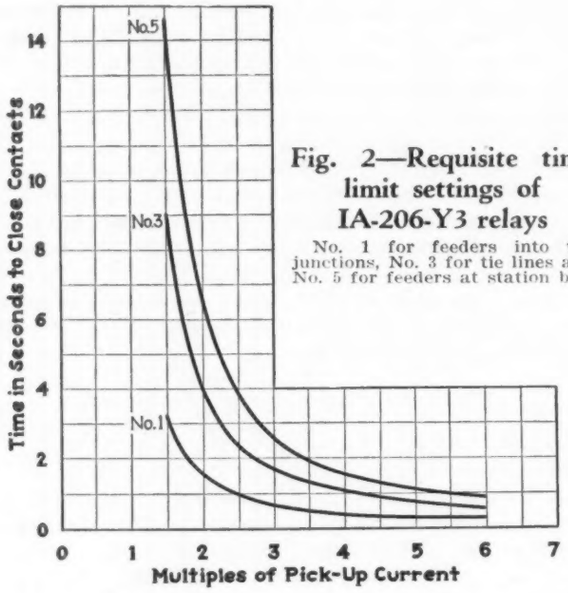


Fig. 2—Requisite time limit settings of IA-206-Y3 relays

No. 1 for feeders into the junctions, No. 3 for tie lines and No. 5 for feeders at station bus.

a ratio of 3:1 and the transformers have 5 per cent reactance; even then the selectivity will be secured, except possibly when a fault occurs near the substation with its transformer out of service or with a fault on the primary side of the corner transformer.

The only cases where overcurrent relays on the network having the same setting will not give selectivity are for faults on the corner network tie lines with the corner transformer out of service. These few cases can be treated as a special problem and be relayed by various methods without much trouble. All other faults under various system and operating conditions will be relayed with positive selectivity.

▼ ▼ ▼

Street-Lighting Program Lags*

FROM 1919 to 1927, the latest period for which figures are available, the municipal expenditures of the cities in the United States have increased 93.4 per cent. The expenditures for street lighting during the same period have increased only 48.6 per cent. This makes street-lighting expenditures lag 44.8 per cent behind the average of all municipal expenditures during this period, and it has not changed materially in the last two years, even though a desire for better street illumination seems to exist among urban residents.

Although these figures are for the average of 250 cities in the United States with a population of 30,000 or over, the cities and towns of lesser population are just as badly in need of modernizing their street lighting. In fact, they are, in general, even more so.

From a paper by Dudley M. Diggs, General Electric Company, before a New York State conference of Mayors and other civic officials.

▼ ▼ ▼

Light and Its Assistant

By M. LUCKIESH
Director Lighting Research Laboratory, Nela Park, Cleveland

MORE light = better seeing = more work is an expression summarizing the contribution that quantity of light makes to industrial efficiency. The term "better seeing" also implies that the additional light aids the eyes in their task and thereby reduces ocular strain. These benefits have often been acknowledged. However, the lighting specialist need not rely only upon the factor of quantity of light to improve seeing. The contrast of the object with its background is comparable in value to quantity of light. Better lighting includes a scientific use of both of these factors, with the factor of contrast regarded as an assistant to light.

The visibility of an object depends upon at least four fundamental characteristics of the object, size, brightness, contrast, and the time available for seeing it. The lighting specialist has control over the factor of brightness and partial control over contrast. By a skillful use of these tools for seeing, quantity of light and contrast, he is enabled to shorten the time required for seeing. While the size of the object is definite, higher intensities of illumination permit smaller details to be seen, and hence light may be considered as a "magnifier" of size. The lighting specialist thus has direct control over two of the four fundamental factors and indirect control over the others.

The following table gives the relationship between these fundamental factors. The effect of changes in brightness, contrast and time is expressed in terms of the minimum size of object required for visibility:

Factor	Range	Type of Object	Smallest Visible Detail (Minutes Visual Angle)
Brightness (millilamberts*	1 to 100	Low contrast	15.1 to 5.0
		High contrast	1.15 to 0.63
Contrast (per cent)	1 to 100	High brightness	20.0 to 0.63
Time (seconds)	0.07 to 0.30	Low contrast	19.0 to 13.0
		High contrast	1.26 to 1.07

(*) A millilambert is the brightness of a perfectly diffusing surface of 80 per cent reflection-factor receiving an illumination of 1.16 foot-candles. (Approximately 1 foot-candle on white paper.)

The fundamental factors of vision were varied over ranges that are important in the science of lighting at the present time. It will be noted that while quantity of light (brightness) is able to effect a 3 to 1 change in size of object just visible, contrast is capable of producing a 30 to 1 change, over its extreme range. In comparison with these factors, time or "speed of vision" is less important.

Minimizing Breakers in Exciter Layouts

By J. B. MacLEAN
J. G. White Engineering Corporation, New York

THE spare exciter, independently driven, is generally connected to an exciter transfer bus through a breaker. The field of each of the main units may be connected to its direct-connected exciter or to the exciter transfer bus by means of one double-throw breaker or two single-throw breakers. In either case these field breakers should be so arranged that it is possible to change over from the direct-connected exciter to the spare exciter without losing the terminal voltage on the main generator and consequently interrupting its service.

With this arrangement it has been necessary to provide some special means for discharging the main field, if the unit is using the spare exciter for excitation. If excitation is removed by opening the generator field breaker, the main field will discharge through the discharge resistors. However, if excitation is removed by opening the spare exciter breaker, the field of the turbo-generator will not be discharged unless some special means has been provided. In the past this has been done in some installations by putting small voltage dischargers on the exciter transfer bus.

Recently it was discovered that this spare exciter breaker was unnecessary. The spare exciter in the new power house for the Pennsylvania State College has been connected solidly to the exciter transfer bus. In two larger plants now under construction this same scheme is being used.

The elimination of this switch between the exciter transfer bus and the spare exciter does not reduce the flexibility of the field system, since both the exciter transfer bus and the spare exciter are mutually dependent for emergency operation. But the omission of this switch has the great advantage of eliminating the necessity for voltage dischargers on the exciter transfer bus.

As it is advisable to be able to change the excitation of any unit from its direct-connected exciter to the spare exciter without interrupting service, the two field breakers connecting the field of any main unit to either its direct-connected exciter or to the transfer bus should not be interlocked. However, the field breaker connecting the field of No. 1 unit to the spare exciter and the corresponding field breaker of No. 2 unit should be interlocked. This interlocking prevents using the spare exciter on more than one unit simultaneously.

By using additional auxiliary switches in the control circuit for interlocking these field breakers this method of interlocking may be extended to three or more main units.

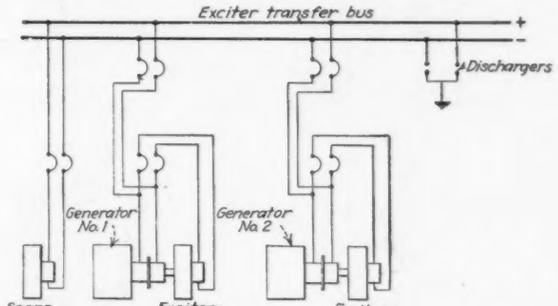


Fig. 1—Exciter circuit with breaker between exciter transfer bus and spare exciter
This arrangement requires dischargers on the bus.

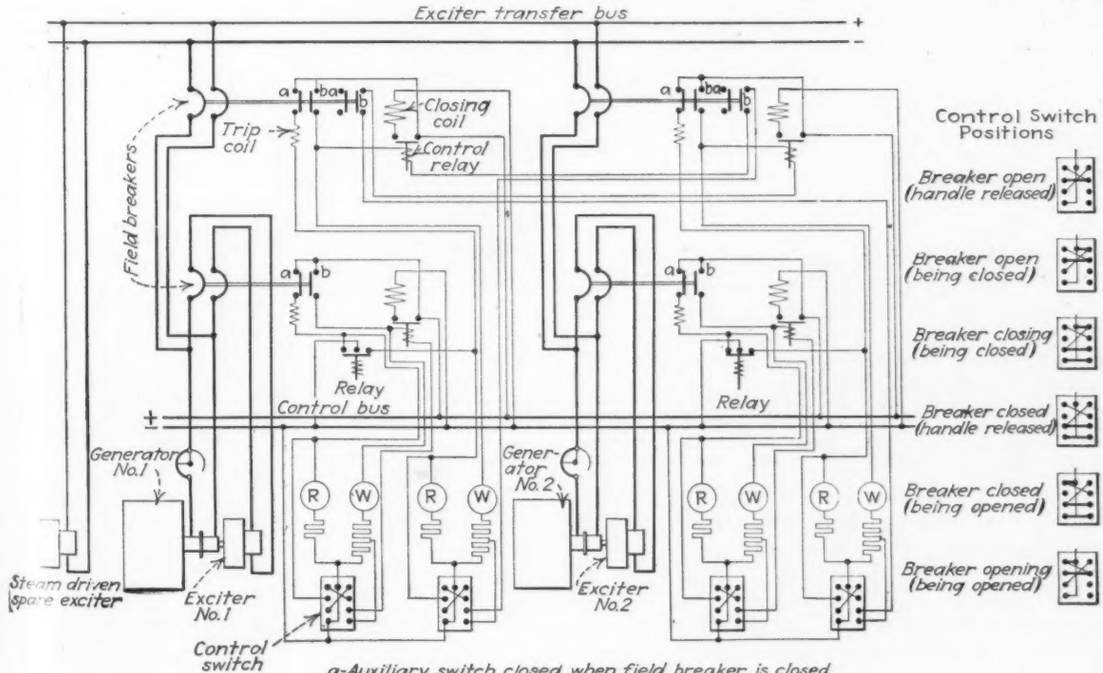
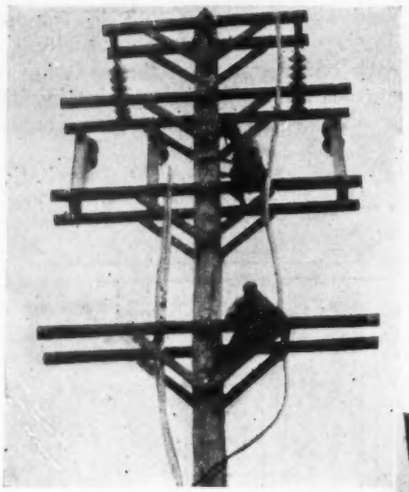


Fig. 2—In this arrangement the spare exciter is connected solidly to the bus, thereby eliminating the necessity of voltage dischargers on the transfer bus

Why Buy Single- for Type H

STEPS IN MAKING CABLE TERMINAL



1. Adding new sheaths

The lead pipe which is shown fastened to the top crossarm is about to be lowered so that the splicer on the bottom arm can thread the shielded phase through it. The other two phases have already been sheathed with lead pipes.

By E. F. NUEZEL

Transmission and Distribution Section, Columbia Engineering & Management Corporation,

Cincinnati, Ohio

2. Sleeve is then brought up

The three lead pipes are shown lowered over the respective shielded phases to within several feet of the three-conductor cable. The lead pipes have an inside diameter of 2 in. to allow a clearance of about ¼ of an inch between the sector shaped phase and the sheath.

3. Sleeve wiped to three-conductor cable

The three - conductor cable was wiped to the sleeve at the bottom and the three single phases have their respective lead sheaths wiped to the sleeve at the top.

IT IS generally agreed that for three-conductor lead-covered cables in the 33-kv. voltage class, terminals should be of the single-conductor type, although three-conductor terminals of even higher voltage are obtainable and are in use in special cases. This practice requires the use of single-conductor cable for the terminal connections and a trifurcated branch splice in the last manhole, or on the terminal pole, to join the three-conductor and single-conductor cables.

The construction of type "H" cable lends itself very satisfactorily to a single-conductor terminal construction which does not necessitate the use of single-conductor cable and yet has all of the reliability with none of the disadvantages of the present single-conductor cable method. It is apparent that electrically, a type "H" three-conductor cable is virtually three single-conductor cables under one lead sheath, so that if we remove the lead sheath, spread the individual conductors and protect each shielded phase with a lead pipe, we will have converted each phase into a lead-covered single-conductor cable. The three lead pipes covering the three single phases can then be connected to the sheath of the three-conductor cable with a wiped branch joint, and the other end of each pipe can be wiped to its respective terminal.

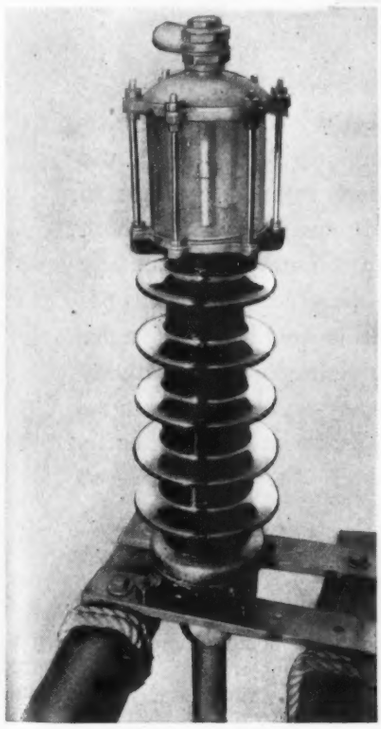
The terminal ends of the single-conductor leads are made up the same as

4. Ready to set terminal

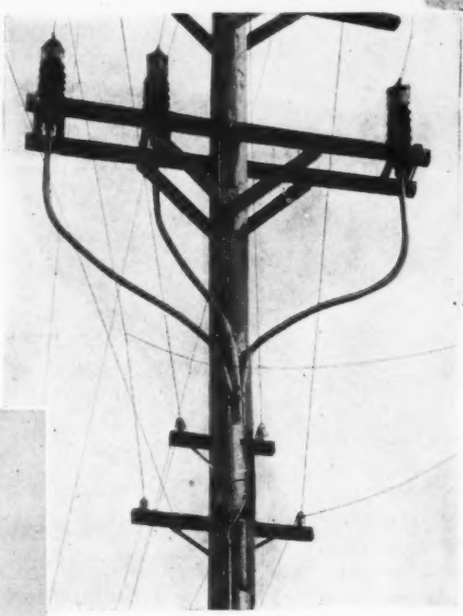
The shielding tape and the lead sheath terminate in a spun copper stress cone.

Conductor Cable Terminals?

for a type "H" single-conductor cable with the shielding tape and the lead sheath terminating in a stress cone. The bottom wipe is made in the ordinary manner, but to accomplish the upper branch wipe, it is necessary to make a lead templet in the field to form the crotch for the three single lead pipes. The entire top assembly of the joint is floated with wiping solder and roofed so as to shed water. The entire assembly is then filled with oil, thereby filling up the spaces between the shielded phases and their respective lead sheaths. There is no electrical hazard involved in this construction, as the metal tapes are at ground potential and the shielded phases pass through the wiped joint with the mill paper intact.

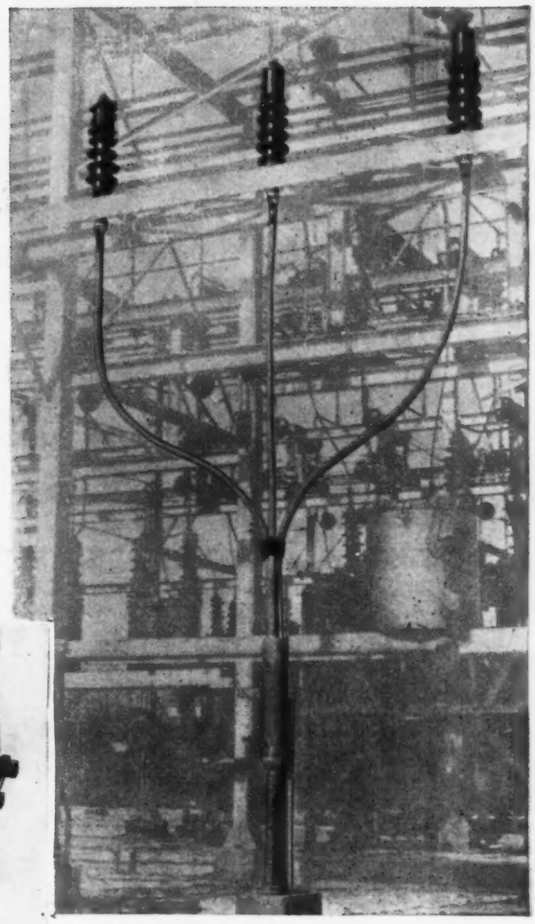


5. Oil-filled terminal in place



6. Finished terminal

Heavy double marlin lacings and lead straps were used to protect the crotch. Copper tubing connections were installed from the sleeve to the ground to permit maintenance of oil in the entire assembly from the ground level while the line is in operation.

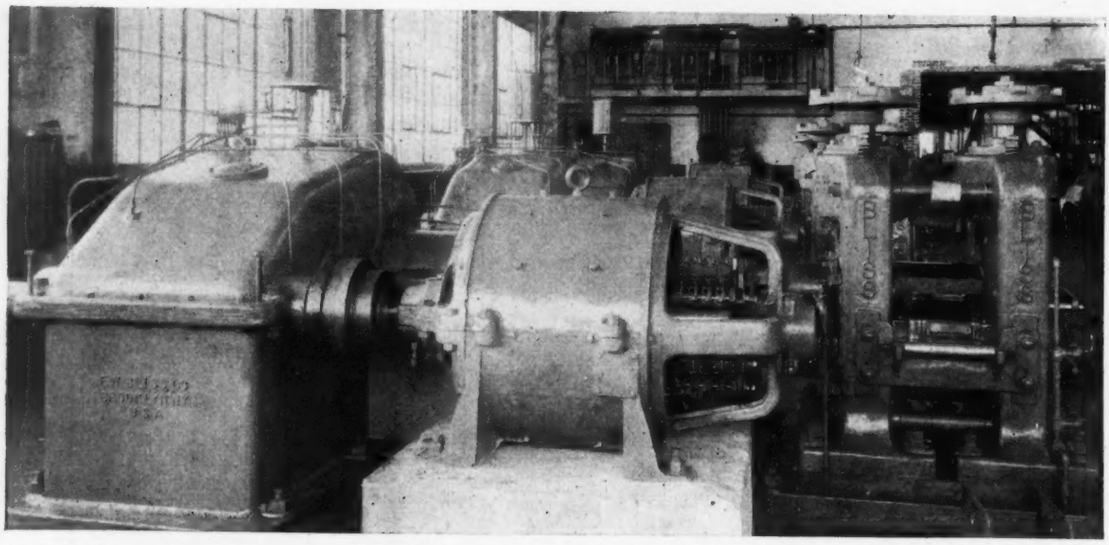


7. Substation terminal

The construction used at the substation end was similar to that on the pole. The elevation of the joint is such that maintenance of oil can be effected from the ground at the filling nipple in the sleeve.

Type "H" branch terminal construction of this type was recently used by the Dayton Power & Light Company on the terminal poles of the underground section of its 33-kv. Millers Ford-Overlook line, and also for the terminal pole and station terminals of its Stillwater substation. The actual construction of the cable terminal work offered no particular difficulties. These installations were cut into service during the latter part of 1929 and have been operating satisfactorily.

This construction is cheaper than the use of single-conductor cables and eliminates the use and hazard of a trifurcating splice in the last manhole or on the terminal pole. Sheath currents are eliminated and it is not necessary to stock single-conductor cable.



Series armature resistance and shunt field control for motors on 12-in. cold strip mills
Three 150-hp., 400 to 800-r.p.m. motors in tandem. Armature control for threading-in and field control for running. (Simplicity.)

Speed Controls for D.C. Motors

By L. F. MILLER

Electrical Engineer Reliance Electric & Engineering Company, Cleveland, Ohio

THE various methods of obtaining adjustable speed by the use of direct-current motors are well known and well understood, but there seems to be more or less question as to which method is most advantageous for any particular application. The purpose of this article is to bring out more clearly the advantages and disadvantages of each system so as to make possible the easier selection of the proper method for any desired application.

THE more usual methods of obtaining adjustable speed for direct-current motors are shunt field control, straight armature control with a series resistance, shunted armature control with a series resistance and a shunt resistance and variable voltage.

Adjusting the speed of a motor by changing the current in the shunt field is a very desirable method on account of the simplicity of control and the close speed regulation that can be obtained. The speed regulation from no load to full load may be held within the limit of 15 per cent without difficulty, and in cases where exceptionally close regulation is desired it may oftentimes be held to a much lower limit.

Another feature of this method of control is that the horsepower that the motor is capable of delivering decreases very little as the speed of the motor decreases. In most cases it may be said that for the largest possible speed ranges the horsepower for the minimum speed will be from 70 to 80 per cent of the horsepower the motor is capable of delivering at the highest speed.

The efficiency is fairly high, depending, of course, upon the size of the motor used, and may be said roughly to vary from 75 per cent on a 1-hp. motor to 90 per cent or even better on a 100-hp. motor. The efficiency is not constant throughout the range, but for the purpose of comparison with the other methods of speed adjustment it may be said to remain approximately the same.

Unfortunately, however, the inherent characteristics of an adjustable speed motor are such that a speed range of more than six to one is very difficult to obtain. It is true that there are specially designed motors, such as the Reliance armature shifting motor, where a speed range of ten to one may be obtained, but for the usual general purpose motor the above ratio holds.

While shunt field control lends itself nicely to many applications, there are many others where constant or approximately constant horsepower throughout the range is not required and large speed range and close regulation are not necessary.

In these cases straight armature control with a series resistance will many times be found to fit the requirements. With this method of control the horsepower the motor is capable of delivering varies approximately with the speed. The disadvantages of armature control are obvious. The speed regulation, while very good at the high speed, becomes poorer and poorer as the speed is decreased, the variation in speed at low speed becoming approximately 100 per cent for a two to one speed range, 200 per cent for a three to one speed range and proportionately higher as the speed range increases.

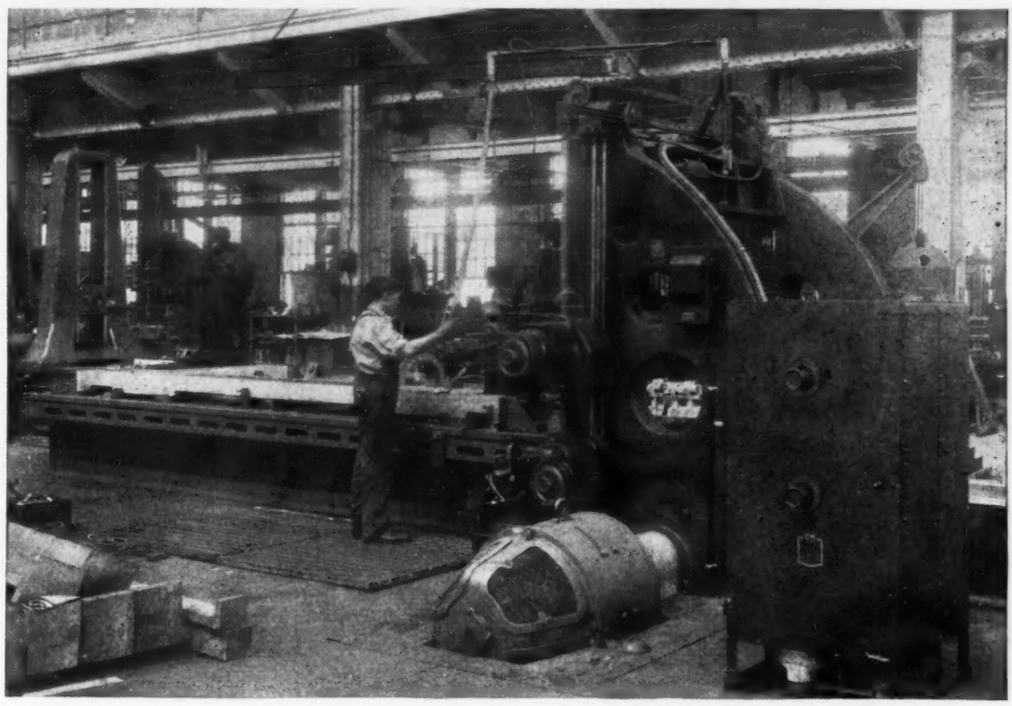
Another undesirable feature is the fact that when operating at the minimum speed an increased torque requirement, such as the motor is perfectly able to handle momentarily, is easily sufficient to stall the motor. For example, a motor operating at one-third off the base or high speed would be stalled by a torque requirement 50 per cent in excess of the normal requirement.

A still further disadvantage is the reduction in efficiency at low speeds. Since the voltage across the armature is reduced by passing the armature current through a resistance, it can be easily seen that with a minimum speed of one-half that of the base speed the over-all efficiency is cut to 50 per cent by the control alone.

In spite of these apparent drawbacks, there are applications, such as fans and blowers, where a large speed range is not desired, close speed regulation is unnecessary and where the load at the minimum speed is so small that the low efficiency can be neglected. In these cases smaller and lower cost motors can be used and good engineering would certainly indicate the use of such motor and control.

Lower efficiency with armature shunted

Shunted armature control, while listed as a separate method above, is really a refinement of straight armature control. In this case a resistance of heavy carrying capacity and low ohmic value is connected across the armature. The result of this change is a lowering of the efficiency over that obtained with straight armature control, since not only is there a voltage loss due to the series resistance but there is also lost all of the current which is being passed by the shunt resistance. This, of course, is a disadvantage, but to offset this the speed regulation becomes considerably better, the amount depending upon the amount of current carried by the shunting resistance as compared with that passing through the armature.



Shunt field control on reversing planer motor

35 hp., 250 to 1,000 r.p.m. A 60-in. x 48-in. x 16-ft. planer. A field rheostat is used for each direction of planer. (Close regulation.)

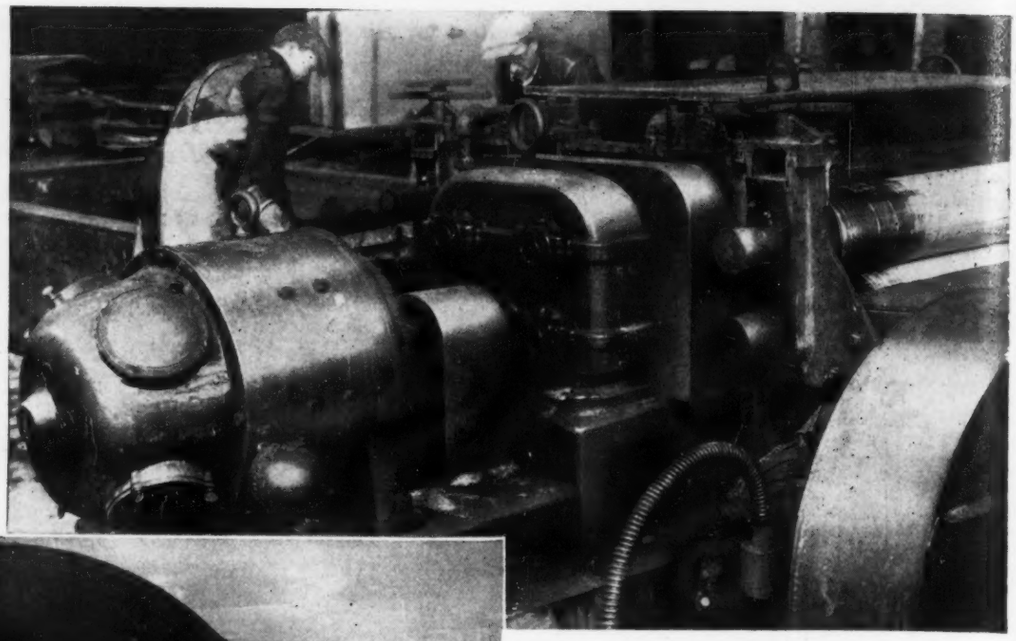
Because of the rather obvious difficulty of changing the series resistance and the resistance shunted across the armature at the same time and in proper proportions, this type of control does not lend itself to an application where a multitude of speeds is desirable, but rather is indicated where only a few speeds lower than the base speed are required.

Variable voltage advantageous but expensive

The variable-voltage method of control, as the name implies, makes use of the scheme of changing the armature voltage on the motor in order to accomplish the desired change in speed. For this two sources of direct-

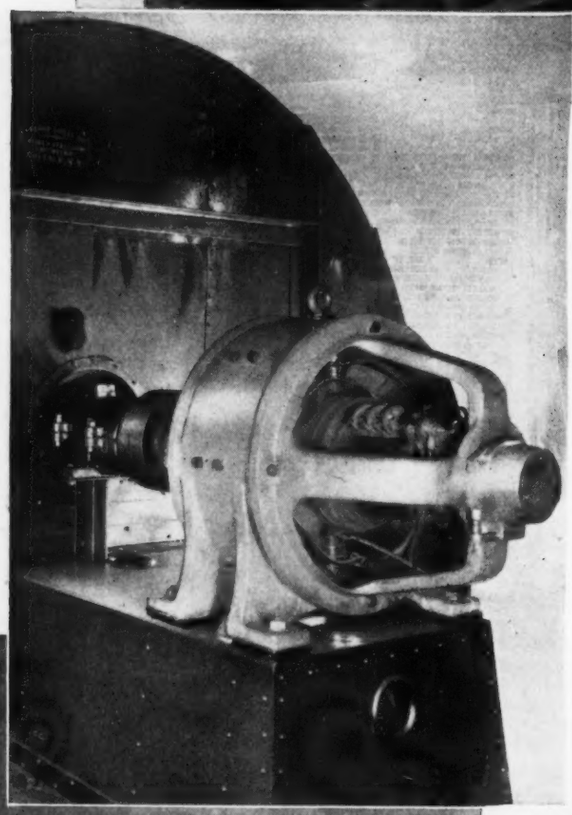
Shunt field control on motor driving scrubber for cleaning sheet steel

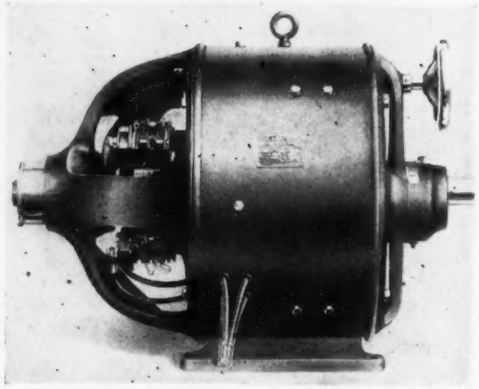
5 hp., 400 to 1,600 r.p.m. (Simplicity.)



Series armature resistance for motor on ventilating fan

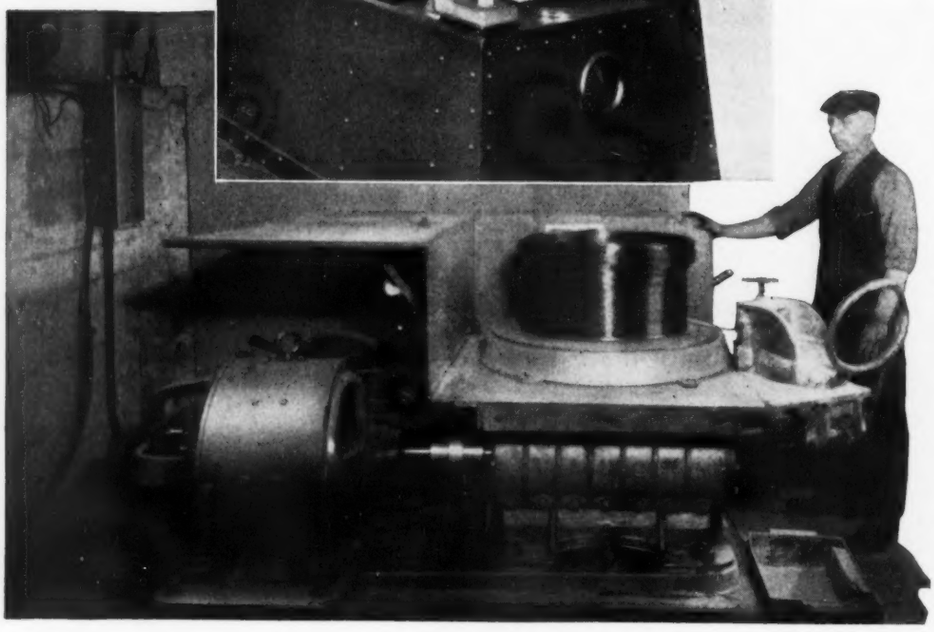
25 hp., 190 to 240 r.p.m. (Simplicity.)





Special design motor for speed changes without external control

Armature is shifted axially and air gap changed to give ten to one speed control and constant horsepower.



Shunted armature resistance and shunt field control on motor for wire drawing block

Main speed changes by shunt field. Shunted armature resistance for threading-in at low speeds.

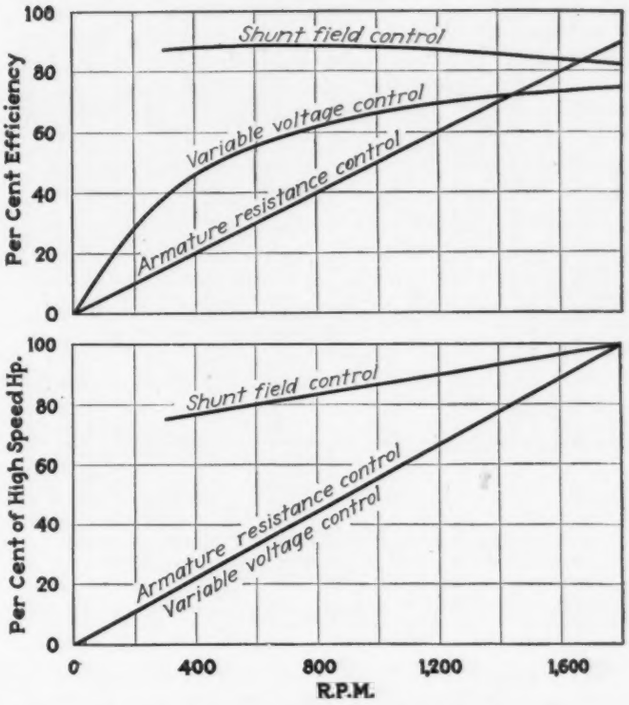
current supply are necessary, one a constant potential supply and the other a supply on which the potential may be varied at will.

In its simplest form it consists of a motor supplying the motive power to a machine, a motor-generator set supplying the power at variable voltage to drive the motor and a constant-potential, direct-current source exciting both the driving motor and the generator of the motor-generator set. This exciting source may conveniently be an exciter attached to the motor-generator set if no other constant potential source is available.

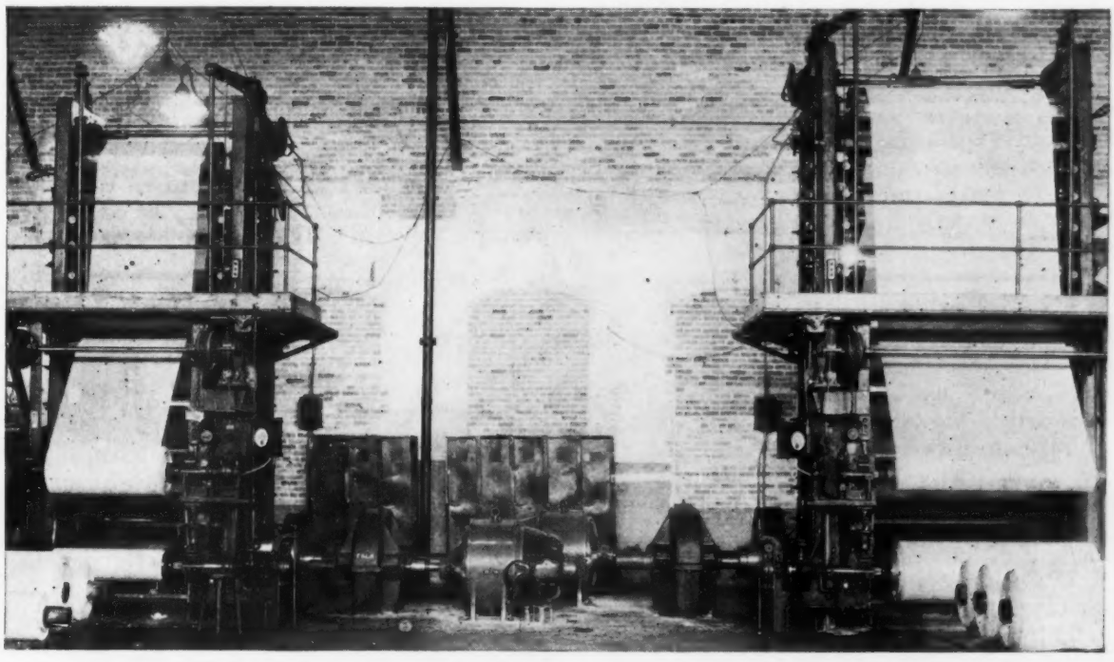
The disadvantage of the variable-voltage method of control is the apparent expense compared to the expense of other methods. However, in many cases this expense is more apparent than real. Many times in checking the actual over-all cost of an application it has been found that while the electric machinery necessary for the variable-voltage control seemed higher in cost than that required for other methods, the over-all cost was the same or less. It would seem, therefore, that on an application which can make use of the advantages of this method of control serious consideration should be given before discarding it on account of the apparently higher cost.

This method of obtaining adjustable speed has many advantages. The method of adjusting the motor speed is just as simple as that of shunt-field control, consisting, as it does, of a field rheostat in the shunt field of the generator. The speed regulation from no load to full load can be held very close at the high speed and need not greatly exceed that which might be reasonably desired at the low speed. The speed range may be very much greater than that which it is practical to obtain with other methods of control. Ten to one range is quite frequently used, and fifteen to one and even, under favorable conditions, twenty to one is not impossible.

Another advantage and oftentimes a very important advantage of this form of control is that it may be used with no additional equipment in plants where nothing but alternating current is available. The horsepower which the motor is capable of delivering varies almost directly with the speed. The efficiency at high speed is lower than any other form of control and at low speed is higher than series-armature control and lower than shunt-field control.

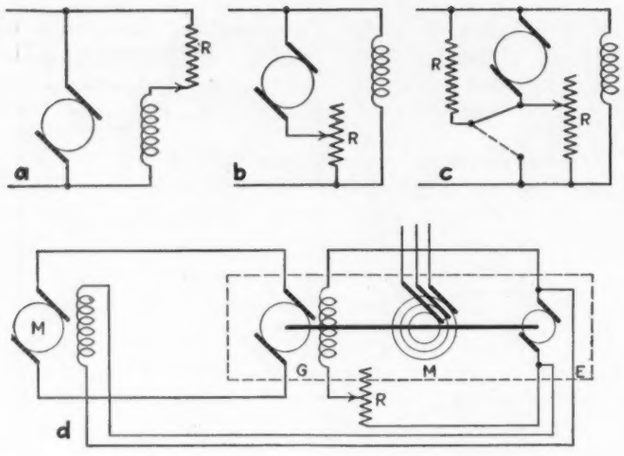


Approximate data on 20-hp., 1,800-r.p.m. motor with speed controls available



Variable voltage control on motors for two super-calenders for finishing paper

75 hp., 50 to 450 ft. per minute paper speed, 575-r.p.m. motors. (Close speed regulation.)



Schematic diagram with motor speed control of several types

(a) Shunt-field, (b) armature series resistance, (c) shunted and series armature resistance, (d) variable voltage.

It is not intended to imply that any one method of control is superior to all of the others for general usage. On the other hand, no hard and fast rule can be set up as a guide to proper selection. Each application must be considered as an individual case and every detail examined before a decision can be reached as to which method or which combination of methods of control should be selected.

▼ ▼ ▼

Power Sales Increased in Norway by Lower Rates

Norwegian experience corresponds with American experience as discussed in recent issue of "Electrical World"*

By T. NORBERG SCHULZ
Director of State Electricity, Oslo, Norway

THAT rate reductions stimulate the use of electricity and that new markets are opened for the sale of electricity by such reductions is well known and are several times pointed out by different writers. The author of this article has attempted to find out an approximative relation between the sale rates and the consumption of electricity and has for this purpose studied a general empirical law for judging this relation.

I have found it of interest to compare the results obtained by E. L. Zuck in his recent article in ELECTRICAL WORLD with the empirical law proposed by the writer and hope to find some interest among the readers of the ELECTRICAL WORLD by shortly referring to this comparison. It is necessary to remember that both examinations are worked out by very different methods and that the material at hand is derived from two different countries, where the conditions for consumption and sale of electricity are very different.

Mr. Zuck has discussed the increase of the kilowatt-hour consumption by reason of decreased rates and has found the relation given in his Fig. 1 by using the data from 40 companies. As a general result he points out that the experience from the five-year period 1924 to 1928 shows that a 1 per cent decrease in rate yields a 2 per cent increase in kilowatt-hour sales per customer.

The writer's equations are the following:

$$E_h = a\, l_i^k \quad \ldots\ldots 1$$

where E_h is the average revenue per kilowatt of the total maximum load, l_i is the average revenue per kilowatt-hour and a and k are constants. This curve is given the name of characteristic curve.

The relation between the average revenue per kilowatt-hour sold (l_i) and the maximum load per inhabitant (L_m)—that is, the total maximum load on the system divided by the number of people in the distribution territory—is called the consumption curve and is expressed by the equation:

$$L_m = b l_i^j \quad \ldots\ldots 2$$

where b and j are constants.

The kilowatt-hour consumption per inhabitant per year (y) should then be:

$$y = L_m \frac{E_h}{l_i} = a\, b\, l_i^{k+j-1} \quad \ldots\ldots 3$$

Assume, for example, that five people are served as one customer on the average, then the average yearly consumption per customer should be:

$$y^1 = 5\, a\, b\, l_i^{k+j-1} \quad \ldots\ldots 4$$

The latest data of the Norwegian Electricity Works gives the following average equation:

$$E_h = 1{,}450\, l_i^{0.6}$$
$$L_m = 0.01\, l_i^{-1}$$

where the values of E_h and l_i are in Norwegian kroner.

If values are in dollars the equation becomes:

$$E_h = 825\, l_i^{0.6}$$
$$L_m = 0.0024\, l_i^{-1}$$

If these values are used in equation (4) then:

$$y^1 = 9.9\, l_i^{-1.4} \quad \ldots\ldots 5$$

In the accompanying table are given values of y^1 for different values of l_i and these may be compared for the American values of Mr. Zuck in Fig. 1 of his article.

		Decrease in Rate Per Cent Recorded from					
l_i	y^1 Kw.-Hr.	l_i= 0.12	l_i= 0.10	l_i= 0.08	l_i= 0.12	l_i= 0.10	l_i= 0.08
$0.12	192	....	..	..	..	..	....
0.10	247	16.7	..	..	29	..	....
0.08	340	33.3	20	..	77	38	....
0.06	505	50.0	40	25	173	105	48.5

Comparing the numbers in the accompanying table with Fig. 1 of the Zuck article it will be found that there is a general conformity, and this is worth noting because the general working conditions in the United States and in Norway are very different. In Norway flat rates are generally used and very cheap prices, while meter rates more generally are used in the United States. There are also other circumstances through which the increase in kilowatt-hours is influenced.

If it is calculated by equation 5, the number of kilowatt-hours yearly that could be delivered per customer

*Issue of August 31, 1929, page 415.

for the sale prices 0.08 and 0.06 cent per kilowatt-hour, we find in the table the numbers 340 and 505.

If we take the average for the twenty companies 3 to 32 in Table I in the article by Mr. Zuck we find that there was used per customer per year in 1924 about 366 and in 1928 about 517 kw.-hr. The average rate per kilowatt-hour was in the same years respectively 8.2 and 6.8 cents.

It is interesting to note that the accompanying table gives approximately the same result as pointed out by Mr. Zuck, i.e., that *1 per cent decrease in rates yields about 2 per cent increase in kilowatt-hours per customer.*

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Lightning Shatters Grounded as Well as Ungrounded Poles

DAMAGE caused by lightning strokes to poles and cross-arms seems to bear little relation to the presence or absence of ground wires, in the experience of maintenance engineers of the Southeastern Division, N.E.L.A. For the last three years the Florida Power & Light Company has been making an annual survey of pole and cross-arm shattering. Its records show that its 14,000 poles, 317 grounded poles and 109 ungrounded poles have been damaged somewhat. About half of these have had to be replaced.

The Alabama Power Company reported that it loses about fifteen poles per year from shattering, out of about 25,000 in service at 11,000 volts. These poles do not have ground wires, and since some of the poles are shattered without damage to wires or insulators, the company does not feel justified in putting ground wires on its poles.

Other companies reported smaller losses, both of grounded and ungrounded poles, and questioned the value of ground wires in affording protection against shattering. This subject was recommended to the overhead systems committee for further study.

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Italy Uses Concrete Poles for 220-Kv. Transmission

IN UPPER Italy a 220-kv. transmission line, one section of which is suspended on centrifugally formed concrete poles, was recently placed in operation. This is said to be the first time that a high-voltage line has been carried on poles of this type, according to the *Elektrotechnische Zeitschrift.*

The line belongs to the Società Idroelettrica Piemonte at Turin and transmits energy from the Eisack-Brixon-Bozen hydro development to the Po plane. The section, which is carried on the new type of concrete poles, is 45.2 miles long.

In this line there are three cables, each with a cross-section of 750,000 circ.mil, serving as main conductors and two galvanized-steel cables, with a cross-section of 140,000 circ.mil, serving as ground conductors. The phase spacing is 23.8 ft., the minimum distance from bottom of sag to ground 26.2 ft. and the average span is 853 ft.

A total of 290 structures, each consisting of two poles and a horizontal member, the latter being also of centrifugally formed concrete, is used. These are connected by means of strong split concrete headpieces. On the standard structure the poles have an over-all length of 69 ft. and a free height of 62.5 ft. Each pole is designed for a top pull of 2,750 lb., with a safety factor of three. The top diameter is 12 in. and the bottom 22.5 in. The horizontal member has a round cross-section with a diameter of 13 in. and a length of 49.2 ft.

The total weight of the structure is 31,500 lb. The dead-end structure is made up of four poles, two two-pole structures, and has a total weight of 86,900 lb. The dead-end poles are designed for a top pull of 5,940 lb. with a safety factor of five.

The poles were manufactured at the Mori plant of the Società Cementi Cirmati Centrifugati at Trieste by a method which was invented in Germany 25 years ago and were installed by that company.

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READERS' FORUM

Getting Business, Managers and Stockholders

To the Editor of the ELECTRICAL WORLD:

I have been very much interested in reading your editorial "Away with Commercial Complacency." I find that there is again developing a strong feeling among operating people that money spent for merchandising is largely waste, and that it would be very much better to let the public come as it will, meanwhile sitting back and taking things as they are, without any forcing or high-pressure efforts.

I also find among many rate experts a growing belief that the stockholders of public utilities have nothing to gain by the inauguration of so-called inducement rates. In a number of places apparently the inducement rates only induce the use of such an amount of increased current as can be had without any increase in customers' bills, a situation which, of course, means that the utility merely furnishes more energy for no greater amount of revenue. If the cost of furnishing the increased energy exceeds the economies which have been developed in the meantime in materials, labor and capital cost, the utility actually is out of pocket, or, in other words, that much closer to no profit at all, or bankruptcy.

There are a number of the older and more experienced people in the industry who regard all of the efforts of the past decade for increased business, merchandising, and the like, as a lot of useless expense, and who claim

that two-thirds of the business which has been secured by these methods would have come anyway without any cash outlay, or without rousing the ill will of electrical contractors, hardware dealers, department stores, and others who feel that merchandising by light, heat and power companies is unfair competition. It is these merchandising efforts, moreover, which have been largely responsible for stirring up much of the public agitation against the industry, so that our efforts to grow have too often resulted in widespread resentment.

Often recently there has developed in the industry a group bowing to the agitation typified by the insurgents in the United States Senate, who believe that the job of the utilities is to give increased service and raise the standard of living, whether there is any profit in it for the stockholders or not. I find that a good many investors in public utility securities are fearful that this tendency may become a keynote of our policy, and hence they are loath to give us any more of their money, and are actually considering whether they should not take out all that they now have in. This, of course, was the attitude toward the railroads during the decade from 1906 to 1916, which ultimately almost resulted in complete government ownership and operation.

Three classes of managers

At present there are three classes of managers in the utility industry as I analyze it:

First—Those who represent many widely distributed stockholders and who work entirely for salaries with more or less institutionalized companies. These, if young and progressive, are interested in expanding the enterprise, giving as much service as possible without, if it can be avoided, reducing the dividends which are being paid, but having little or no desire to increase dividends. If they are older, they are much the same except that they have lost the desire to expand and are entirely satisfied if they can be let alone and not bothered.

Second—Those who are employed by bankers and speculators who are solely interested in profits, and quick profits at that; who have little or no interest in the ultimate success of the public utility industry, whether the public is well served or not, or anything else except such matters as will, during their continuance in position, permit them to realize the largest profits on the stock they have bought or the warrants they own. These interests are possibly desirous of selling as much of their holdings to the general public as will show most profitable returns, and at the same time allow them to retain dominating positions on the boards of directors, so that they may control the banking and other large-scale profit-making possibilities of the future, without, however, assuming any of the responsibilities for fundamentally successful and profitable operations from the standpoint of stockholders, customers and employees.

Third—Owner-managers who have spent the best years of their lives building up the enterprises of which they are now in charge or in which they have controlling interests, who operate their properties as closely as they can as though they were private businesses, with due regard, however, for what is called enlightened self-interest, which requires that they shall consider, as is true of all successful businesses:

1. The interest of their customers with whom they carry on business and from whom they derive the funds with which they pay the wages and secure the continued interest and co-operation of their employees.

2. The interests of the investors who hold their debt securities, their quasi-partners who own preferred stock, and their full partners who own general equity securities, take the greatest risk and in return expect to share the remaining profits in such amounts as can and ought to be withdrawn from the business without impairing its future success, but in any case as large as such investors could reasonably expect in any other kind of enterprise.

3. The necessity of keeping all these investors, including all their own partners, as well satisfied as possible.

This third class of owner-managers, however, who are individually minded, are not in agreement with the extreme socialistic reform element which believes that, regardless of anything else, the interest of the general public shall be the first, even though the business becomes bankrupt. In fact, many of the socialists wish it would become bankrupt so it could be handled in accordance with the tenets of state socialism. Such managers are subjected to the harassment and criticism of the other classes—on the one hand, the speculative group, which resents their indifference and refusal to hand over large concessions on financing, and which is also fearful that they may take exception to some of the principles and viewpoints of such groups whose interests in the industry are necessarily not of long duration and continuing character, but have more nearly to do with immediate profits, and, on the other hand, the institutional group who are fearful that the individualistic managers will stir up the politicians and disciples of state socialism, and even the public generally, by their independent attitude and by their insistence upon the property rights of themselves and their stockholders to a reasonable profit before they begin to dispense concessions in the way of reduced rates or increased service beyond what is economically warranted, even though demanded by public agitation led by demagogic politicians.

I should be very much interested if you could develop some comment and study by thoughtful persons along the line of the foregoing in the ELECTRICAL WORLD. I think this would have a lot more effect than many of the generalities with which the literature about the industry is so impregnated.

Stockholders resent large expenditures for advertising

During the next year or two there is going to be a strong drive on the part of the public and from within the industry against the large expenditures which are now being made in connection with inducing the greater use of current, load building, and heavy expenses which have to be incurred to aid business which is thus secured. Many letters are received from stockholders who resent the large expenditures which are being made for advertising, both general and specific, particularly the former. It seems impossible to educate stockholders to the idea that if the business is to grow it must have increased capital and that support cannot be had from investors, either those who are already stockholders or those who are strangers to the enterprise, unless interest is induced and retained, and this can only be done through advertising, which costs money. Furthermore, securities have been unloaded to a considerable extent on thousands of individual investors who are blindly disgusted, without much about why and how, with the recent decline in prices and the small dividends which they currently receive on their investments.

A UTILITY EXECUTIVE.

Men of the Industry

Utah Utility Announces Personnel Changes

E. R. OWEN, who has been manager of the Utah Power & Light Company's Logan division for the past seventeen years, has been transferred to the company's general offices at Salt Lake City. Mr. Owen's successor is JAMES A. BULLOCK, who for the past nine years has been chief clerk of the company's Provo division. The company's Logan division headquarters will also be moved from Logan, Utah, to Preston, Idaho, owing to a change in territorial boundaries as between its Logan and Ogden divisions, which made Preston a more centralized location for Logan division. JAMES F. ORR, who has been manager of the Utah Power & Light Company's Ogden division for the past three years, is leaving September 1 to become commercial manager of the United Gas Corporation, with headquarters at Houston, Tex. LESLIE W. NIMS, manager of the company's Provo division for the past three years, succeeds Mr. Orr at Ogden. WILLIAM A. HUCKINS, who has been sales superintendent of the Ogden division for about ten years, is promoted to the position of manager of the Provo division to succeed Mr. Nims.

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E. D. HURT has been placed in charge of the Auburn (Ala.) district recently established by the Alabama Power Company.

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ROY T. PORTER, formerly assistant manager of the Macon division of the Georgia Power Company, has been appointed assistant division manager of the Columbus division. A graduate of the Alabama Polytechnic Institute, Mr. Porter was associated with the Alabama Power Company before joining the Georgia utility in 1927 as superintendent of the Dublin division.

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F. U. Ross, formerly sales manager of the Virginia Electric & Power Company at Suffolk, has been appointed manager of the Williamsburg district of the Richmond division to succeed W. P. Venable, who resigned to join the Western Public Service Company at Scotts Bluff, Neb. Upon receiving his E.E. degree from Tri-State College of Engineering at Angola, Ind., he served his electrical apprenticeship with the Westinghouse Electric & Manufacturing Company at East Pittsburgh and with the Westinghouse Lamp Company at Bloomfield, N. J. It was when Stone & Webster took over the Virginia properties that Mr. Ross was assigned to the distribution engineering department of the Virginia Electric & Power Company.

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B. H. Peck Chief Engineer of Utility Commission

BERT H. PECK, well-known engineer, has been selected by the Public Utilities Commission of the District of Columbia

to fill the position of chief engineer, recently created. The duties of this office are to act as head of the commission's engineering organization, plan and organize the work of the engineering department, supervise the service, valuation and inspection branches of the engineering force, inspect all new construction and make reports to the commission on rates, valuation, depreciation and service, draft engineering reports, and similar activities. With his broad background of engineering training and practical experience, Mr. Peck is well equipped to handle this formidable array of tasks.

A graduate of the University of Wisconsin in electrical engineering, class of 1906, Mr. Peck spent two years in the employ of the Illinois Bell Telephone Company in its engineering department and six years in the employ of D. C. and William Jackson, consulting engineers, engaged upon valuation and construction work of a varied nature. From 1914 to 1919 he was identified with the Illinois Public Utilities Commission, now known as the Illinois Commerce Commission, in the capacity of electrical engineer. In 1919 he became general manager of the Southern Illinois Light & Power Company, which was later merged with other properties to form the Illinois Power & Light Corporation. He remained with the new organization in charge of its southern Illinois properties with the title of general manager of the Southern Illinois division. In 1927 he joined the Allied Chemical & Dye Corporation as assistant general manager of the Solvay Process Company, remaining until 1929. Since that time he has been engaged in various engineering undertakings. Mr. Peck is a member of the American Institute of Electrical Engineers and of other technical societies.

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EUGENE MOHR, Maquoketa, Iowa, has been named manager of the Maquoketa district for the Iowa Electric Company, to succeed M. A. Harrison.

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JAMES L. DAVIDSON, who has been handling transportation sales work in the Norfolk district of the Virginia Electric & Power Company, has been made sales manager at Suffolk to succeed F. U. Ross, now district manager at Williamsburg. Mr. Davidson has been connected with the Virginia utility since 1927.

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R. H. THOMSON, who served as Seattle city engineer under a number of administrations prior to 1912, again has been named city engineer to succeed William D. Barkhuff, who was killed in an automobile accident in July. The appointment was made by Mayor Frank Edwards and was unanimously confirmed by the City Council. Mr. Thomson is 74 years of age and served as Seattle city engineer from 1892 to 1911. He fought for the acquisition of Cedar River as Seattle's water supply, and among other projects with which he was identified in past administrations were the Denny Hill, Jackson Street, Second and Third Avenue regrades and the North Trunk sewer tunnel. Since leaving the service of the city in 1911, Mr. Thomson has been engaged in private practice as consulting engineer. He also served one term as Seattle City Councilman.

R. B. JOHNSTON, for many years a member of the editorial staff and later on the advertising staff of the *Journal of Commerce,* has resigned to become director of publicity for the Puget Sound Power & Light Company, Seattle, Wash.

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DUGALD C. JACKSON, JR., for five years head of the department of mechanical and electrical engineering in the Speed Scientific School of the University of Louisville, has been appointed head of the department of electrical engineering in the University of Kansas. Previous to his association with the teaching staff of the University of Louisville, Professor Jackson was for two years assistant professor in charge of electrical engineering at Trinity College, Duke University, Durham, N. C. He holds degrees from Harvard University and from the Massachusetts Institute of Technology, where his father is head of the department of electrical engineering.

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THEODORE DREIER, graduate of Harvard, and for the past five years an electrical engineer at the General Electric Company in Schenectady, N. Y., has been appointed assistant professor of physics at Rollins College for the coming year. He will fill a vacancy caused by the death of Dr. William S. Franklin in June. Mr. Dreier was graduated from Harvard with an A.B. degree in 1923 and from the Harvard Engineering School with the degree of S.B. in electrical engineering in 1925. He joined the engineering staff of the General Electric Company in 1925.

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J. B. BROKAW, recently chief engineer of the Eastern Oregon Light & Power Company, Baker, Ore., has resigned to accept the position of assistant manager with the Peoples West Coast Hydro-Electric Corporation, California Public Service Company and Western States Utilities Company with headquarters in Portland, Ore. These companies are subsidiaries of the Peoples Light & Power Company, New York. Mr. Brokaw has a background of extensive practical engineering experience obtained with many utility companies, including the Berlin Light, Heat & Power Company, Berlin, Wis.; the Commonwealth Electric Company, Chicago; the Idaho Consolidated Power Company, and the Northern States Power Company. He joined the Eastern Oregon Light & Power Company as division manager at La Grande, Ore., in 1921. Mr. Brokaw is a member of the American Institute of Electrical Engineers, the Professional Engineers of Oregon and is active in the engineering section of the Northwest Electric Light & Power Association.

W. A. Buchanan Heads Accident Prevention Committee

WALTER A. BUCHANAN, district manager of the Appalachian Electric Power Company at Welch, W. Va., has been appointed chairman of the national accident prevention committee of the National Electric Light Association. Mr. Buchanan entered the manufacturing branch of the electrical industry in 1919 as an employee of the General Electric Company at Schenectady. Subsequently he engaged in test work there and at the Pittsfield Works. After about a year he transferred to the central-station field with the Kentucky & West Virginia Power Company at Sprigg,

W. Va., as meter superintendent, later being made assistant manager. In 1922 the Kentucky & West Virginia Power Company was taken over by the American Gas & Electric Company and in a short time Mr. Buchanan was transferred to Logan, W. Va., as assistant manager of that division.

After the Appalachian Electric Power Company absorbed that part of the Kentucky & West Virginia Power Company located in West Virginia he was sent to Huntington as general superintendent. It was just about a year ago that he removed to Welch as district manager, his present position. Mr. Buchanan has been active in association work, having been a chairman of the accident prevention committee of the East Central Division of the National Electric Light Association for the year 1927-28, and held the same office for the year 1928-29. In June, 1929, he was appointed vice-chairman of the national accident prevention committee, which he now has been selected to head for the year 1930-31.

LEWIS GRANDY, professor of electrical engineering at the University of Mississippi for the past three years, has tendered his resignation to Chancellor J. N. Powers to take effect September 1. He has accepted the position of professor of electrical engineering at Texas Technological College, Lubbock.

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OBITUARY

FRANK L. DRIVER, SR., chairman of the board of directors of the Driver-Harris Company, Harrison, N. J., died August 26 at Zoute-sur-Mer, Belgium, in his sixty-first year.

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ROBERT M. ADAMS, formerly secretary of the Los Angeles Gas & Electric Corporation, died August 12. He had entered the service of the Los Angeles company in August, 1889. On January 26, 1910, he was made secretary and treasurer, a position which he held until his retirement on May 1, 1916. Mr. Adams had been in ill health for a number of years.

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WILLIAM F. WILLMANN, assistant purchasing agent of the Edison Electric Illuminating Company of Boston, Mass., died at Boston August 24 after several months of ill health. Mr. Willmann was a native of Boston and had been in the employ of the company for 25 years, his work having included service in the standardizing and testing department, the station engineering department and later in the electrical division of the latter. About six years ago he was transferred to the purchasing department as assistant superintendent, and in 1929 was appointed to his late position.

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GORDON H. BALCH, vice-president of the Hanover Bank & Trust Company, New York, and a director in the General Public Service Company, died suddenly August 24 while visiting friends in Greenwich, Conn. Mr. Balch was affiliated with Stone & Webster during the largest part of his career, first as secretary to Mr. Stone and more recently as manager of the New York office. He was born in Bozeman, Mont., and was graduated from Harvard in 1912. After serving as private secretary to the United States Minister in Belgium for a short time he joined Stone & Webster, continuing until 1917, when he left for the war. After the armistice he returned to the engineering corporation, where he remained until 1922, when he joined the American International Corporation. Mr. Balch was 42 years of age.

Financial and Statistical News

SUPPORTED by other favorable factors, the 4 per cent rise in ingot production of the United States Steel Corporation was the signal for the mid-week buying movement which boosted quotations in most groups of stocks. Utility stocks shared the revived interest.

——PREDICTIONS OF FIRMER MONEY COMMENCING WITH LABOR DAY have been general, although a weakening tendency in certain classes of paper has been in evidence this week.

——FORECASTS OF BUSINESS REVIVAL CONTINUE, but few tangible evidences of definite improvement are yet available.

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North American Assets Total $807,498,339

THE QUARTERLY CONSOLIDATED BALANCE SHEET of the North American Company shows the results of the transfer of the company's California properties to the Pacific Gas & Electric Company and of the acquisition in return of a large block of that company's common stock. Total assets as of June 30, 1930, amounted to $807,498,339, as compared with $863,671,243 for the similar period of 1929, a decrease of $56,172,904. Investments in property and plant show a decline of $137,936,157, while investments in the securities of other companies show an increase of $75,241,759. Current assets showed an increase of approximately $10,000,000.

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Four per Cent Increase in Canada

CENTRAL ELECTRIC STATIONS IN CANADA recorded a 4 per cent increase in output during the first half of 1930, compared with the corresponding period of 1929. The output for the first six months amounted to 8,898,973,000 kw.-hr., of which 8,743,710,000 kw.-hr. was generated by water and the balance by fuel. In the first half of 1929 production totaled 8,568,774,000 kw.-hr.

In the production of electric energy generated by water power, all five economic areas, except the prairie provinces, show an increase over 1929. Output in Maritimes amounted to 172,232,000 kw.-hr., up from 90,222,000 kw.-hr. last year. Quebec advanced from 4,362,375,000 to 4,389,426,000 kw.-hr., while Ontario reported a gain of about 82,000,000 to 3,087,023,000 kw.-hr. Production in the Prairie Provinces declined from 612,722,000 to 556,411,000 kw.-hr. British Columbia recorded a nominal increase from 535,232,000 to 538,618,000 kw.-hr. The half-year's export was 739,351,000 kw.-hr., 6 per cent more than the 693,948,000 in the corresponding period last year.

Summer Output Below Last Year's

THE AMERICAN GAS & ELECTRIC COMPANY reports an output of 72,381,217 kw.-hr. by its subsidiaries for the week ended August 16, 1930, a decrease of 4 per cent below the corresponding period last year.

The power output of the electric subsidiaries of the American Water Works & Electric Company for the month of July totaled 150,039,797 kw.-hr., a decrease of 5 per cent from the output of 157,902,254 kw.-hr. for the corresponding month of 1929. For the seven months ended July 31, 1930, power output totaled 1,109,481,005 kw.-hr., 1 per cent greater than the output of 1,103,036,730 kw.-hr. for the same period last year.

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Regulate Operating but Not Holding Companies*

By MARTIN J. INSULL
President Middle West Utilities

DEMAND for regulation of electric light and power holding companies seems to be based on a misconception of the electric industry, which in actuality is a thing in action, growing, changing, improving all the time.

We have to recognize spirit, motive, incentive, initiative and enterprise as the real driving forces which give life to this industry, as they give life to all human accomplishments. In the pure reasoning of the cloister these forces can perhaps be ignored. In the actual job of furnishing electric service they must be reckoned with.

I dare say that the electric industry never wins a debate and its critics never produce a kilowatt of electricity. It is in keeping with the ultimate fitness of things that critics criticise and electric power men furnish electric power.

If the service is extended into new territories, there is little likelihood that either the bondholders or the preferred-stock holders will be subject to loss. If rates are reduced in the expectation that consumption will thereupon increase, the investment of the bondholders and preferred-stock holders is not likely to be jeopardized whether the increased consumption materializes or not.

In either case it is the common-stock holder who risks the possibility of loss. That is the way it goes in the actual day-to-day job of providing electric service. It is the industry's job not only to meet the present demand of present consumers at present prices, but also to increase the uses of electricity, to extend it to an increasing number of consumers and to make it constantly less expensive. Responsibility must be assumed and risks must be taken. The determining factor is the attitude and policy of the owners of the common stocks of the operating companies.

Common-stock ownership

These extensions of service, reductions of rates and increases in consumption are the very keynote of the industry's growing usefulness to the nation. How are they accomplished? They are

**From an address before the Institute of Public Affairs, University of Virginia.*

all made possible by the assumption of responsibility by the holders of the operating companies' common stocks, who in most cases are the public utility investment or holding companies.

No element is more important to the progress of the industry than the character of the common-stock ownership. The attitude and policy of the holders of the operating companies' common stock determine whether the operating company shall pursue a progressive course or simply stand still and "let well enough alone."

The continuing progress of the industry is largely due to the ownership of the common stocks of operating companies by organizations which are trained and experienced in the utility business, organizations which can take risks because of their diversified investments and their experience in having met similar conditions before, organizations which know the objectives and the method of realizing them.

If the common stocks of these operating companies were owned by individual investors—the people who generally own the bonds or preferred stocks—they either would not meet such investors' requirements or else a policy of caution would be applied to them, and the extension of the service and reduction of rates would be retarded. Since the owners of the common stocks take the responsibility involved in the progressiveness of the operating companies, it is greatly to the interest of the consumer that the common-stock ownership rest with such agencies as holding companies.

The incentive to take these forward steps must be kept alive. Freedom of action and the privilege of risking a loss as well as making a profitable investment are necessary as a motive force. Neither will long exist under a restrictive regulation.

The holding company requires for the successful performance of its function the same freedom of action as any other business. It is that freedom that has enabled it to do the great work it has done in the development of the electrical industry in this country to a pre-eminent position in the whole world. Without it that development would not have taken place and future development will be materially retarded.

Regulation of the operating company with freedom of the holding company is to the best interest of the public. The public is thus protected against monopoly and has the advantage of the initiative and enterprise that financially strong private business brings to institutions where its money is invested.

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Ohio Utility Offers New Preferred Issue

OFFERING HAS BEEN MADE of a new issue of 6 per cent prior preference stock of the United Ohio Utilities Company at 98½ per share and accrued dividends, to yield 6.09 per cent. United Ohio is controlled indirectly by the United Light & Power Company. Proceeds of this issue will be used for the retirement of 7 per cent prior preference stock of the company to the amount of $1,262,800.

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Common Stocks Yield Around 3 per Cent

PUBLIC UTILITY COMMON STOCK YIELDS are still in the neighborhood of 3 per cent. Below is a group of New York Stock Exchange power and light common stocks with a yield range of 1.11 to 4.96 and an average of 2.9 per cent, disregarding stock dividends.

Accompanying is a list of New York Stock Exchange preferred stocks of power and light companies. The average yield is 5.87 and the range 5.10 to 6.19 per cent. The yield of electrical equipment common stocks is, of course, higher than that of the utility group. The average of the group here shown is 5.64 per cent.

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Rapid Growth of German Utilities

THE CONSTANT GROWTH of production and consumption of electrical energy in Germany is clearly indicated by the following figures for public utility plants:

Years	Capacity, Thousands of Kw.	Energy Generated, Millions of Kw.-Hr
1914	1,600	2,782
1919	2,529	5,067
1925	4,458	9,760
1928	6,496	14,479

Of 1928 output in kilowatt-hours 83.8 per cent was generated by steam, 15.7 per cent by hydro, 0.1 per cent by gas and 0.4 per cent by oil. Furthermore 56.6 per cent of this output was supplied by governmental and municipal stations, 14.6 per cent by private stations and 28.8 per cent by mixed stations, i.e., owned partly by private capital and partly by public authorities.

The 1928 output figures do not include energy generated and used by industries in their own plants, such output being estimated at more than 14,000,000,000 kw.-hr.

Analysis of customers supplied by public central stations shows the following figures:

Class	Number of Customers	Consumption, Kw.-Hr.
Large consumers	32,934	7,450,941,000
Small light and power, including domestic	5,654,221	2,185,011,000
Rural	2,393,763	644,471,000
Public lighting	543,936	104,493,000
Railways	227	1,078,688,000

Yield of Utility and Manufacturing Stocks

Preferred Stocks

	Price Aug. 23	Dividend	Yield Per Cent
American & Foreign Power	98¼	6	6.11
American Power & Light	102½	6	5.85
Columbia Gas & Electric	109	6	5.50
Commonwealth & Southern	101¼	6	5.93
Electric Power & Light	99	6	6.06
Engineers Public Service	98	5	5.10
Standard Gas & Electric	66½	4	6.04
Standard Gas & Electric	101¾	6	5.88
Standard Gas & Electric	113	7	6.19
United Corporation	50⅜	$3	5.96
Average			5.87

Common Stocks

American Power & Light	83	$1 and 4 per cent stock	1.20
American Water Works & Electric	89¾	$1 and 5 per cent stock	1.11
Columbia Gas & Electric Co	60⅜	$2	3.31
Commonwealth & Southern	13¾	60 cents	4.96
Detroit Edison Co	218	8	3.67
Electric Power & Light	69	1	1.44
Engineers Public Service	49¾	$2.40	4.82
Federal Light & Traction	65	1½ and 4 per cent stock	2.31
National Power & Light	45½	1	2.21
North American Co	99¾	10 per cent stock	....
Pacific Gas & Electric	54	2	3.70
Pacific Lighting	75½	3	4.04
Standard Gas & Electric	102⅞	3½	3.40
United Corporation	32¼	50 cents	1.55
Average			2.9

Manufacturing Stocks

Allis-Chalmers Mfg	54	3	5.56
Electric Auto-Lite	68	6	8.82
Cutler-Hammer	59	3½	5.93
Electric Storage Battery	64	5	7.81
General Electric	71	1.60	2.25
Westinghouse Elec. & Mfg. Co	145⅞	5	3.44
Average			5.64

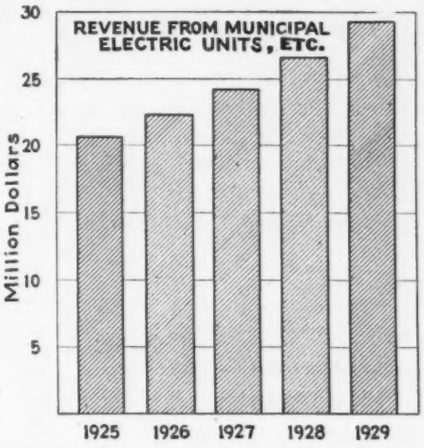
Ontario Hydro Earnings Increase 10 per Cent

AN INCREASE of 10.7 per cent is shown in the earnings for 1929 of electric utilities under the jurisdiction of the Hydro-Electric Power Commission of Ontario. Surplus less depreciation after all charges was $2,401,376, against $2,016,452 in 1928 and $1,273,096 in 1927. Total assets of the system increased from $98,312,385 in 1928 to $106,909,146 last year.

The total capital investment of the Hydro-Electric Power Commission of Ontario in power undertakings and hydro-electric railways is $222,082,637. In addition, municipalities have invested in utility systems and other assets $92,154,280, making a grand total of $314,236,917.

The total revenue derived from the operation of these properties last year was $39,969,624. This is constituted as follows:

From municipal units, rural power districts, hydro-electric railways and other power customers		$25,294,951
From rural consumers		1,688,632
From hydro-electric railways		1,358,989
		$28,342,574
Collected by municipal utilities		29,206,684
Total		$57,549,258
Deduct revenue from power supplied to utilities and electric railways		17,579,633
		$39,969,624



In the above tabulation the first two items, totaling $26,933,584, represent revenue collected from the municipal utilities and other customers for power supplied. This sum was appropriated to meet all the necessary fixed charges and to provide for the expenses of operation and administration. After all charges there was a net surplus of $1,575,225. Details are as follows:

Revenue		$26,983,584
Operation costs	$18,048,129	
Reserves	7,360,229	
		25,408,358
		$1,575,225

Electricity Sales in England Increase Rapidly

SALES OF ELECTRICITY TO CONSUMERS in England have increased from 3,121,000,000 kw.-hr. in 1921-22 to 7,800,000,000 kw.-hr. in 1928-29, or approximately 150 per cent, representing an average increase of nearly 670,000,000 kw.-hr. a year in that period, according to the annual report which has been issued by the Electricity Commission, transmitted to the Department of Commerce by Assistant Trade Commissioner R. S. Charles, London.

This is a more rapid percentage increase than that of sales of electricity in the United States, where the increase from 1922 to 1929 was 105 per cent.

The production of the public supply in 1928-29 involved the operation of 485 generating stations having a capacity of 5,801,770 kw. Regarding the concentration of generating plant, upward of 69 per cent was contained in 76 stations, each having an installed capacity of 25,000 kw. or more, and 31 per cent was distributed among the remaining 409 stations, of which 200 had an installed capacity of less than 1,000 kw. each. A net addition of about 543,000 kw. was made to the plant capacity of authorized undertakings during the year 1928-29. Installation of large modern units continued, and at the end of 1928-29 about 49 per cent of all the generating plant was in steam turbo-alternator units of 10,000 kw. or larger.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Arkansas Power & Light (Year ended June 30)					
Gross earnings	$8,756,167	$7,712,567	14.0	53	52
Net earnings	4,144,209	3,711,899	12.0	..	..
Cities Service (Year ended July 31)					
Gross earnings	57,759,847	39,175,751	47.2	..	..
Net earnings	55,889,192	37,961,997	47.2	..	..
Columbia Gas & Electric & Subs. (Year ended June 30)					
Gross earnings	104,074,522	105,261,498	—1.1	57	56
Net earnings	44,230,510	46,127,298	—4.1	..	..
Dallas Power & Light (Year ended June 30)					
Gross earnings	5,224,147	4,995,491	5.0	47	45
Net earnings	2,777,885	2,726,605	2.0	..	..
Detroit Edison (Year ended July 31)					
Gross earnings	55,674,049	55,629,312	0.1	67	65
Net earnings	18,158,945	19,305,013	—5.9	..	..
Idaho Power (Year ended June 30)					
Gross earnings	4,023,939	3,632,287	11.0	49	47
Net earnings	2,053,446	1,912,016	7.0	..	..
Kansas Gas & Electric (Year ended June 30)					
Gross earnings	6,045,355	5,557,222	9.0	53	53
Net earnings	2,864,459	2,591,555	11.0	..	..
Louisiana Power & Light (Year ended June 30)					
Gross earnings	5,770,470	4,548,031	27.0	52	52
Net earnings	2,753,781	2,198,620	25.0	..	..
Louisville Gas & Electric (Year ended June 30)					
Gross earnings	10,391,661	10,001,144	3.9	..	..
Net earnings	5,401,555	5,146,341	4.9	..	..
Memphis Power & Light (Year ended June 30)					
Gross earnings	6,687,024	5,933,353	13.0	60	59
Net earnings	2,685,382	2,403,446	12.0	..	..
Minnesota Power & Light (Year ended June 30)					
Gross earnings	6,362,218	6,201,656	3.0	38	35
Net earnings	3,911,676	4,015,805	—3.0	..	..
Nebraska Power (Year ended June 30)					
Gross earnings	6,296,680	5,653,509	11.0	50	51
Net earnings	3,165,157	2,767,860	14.0	..	..
Northern States Power (Year ended June 30)					
Gross earnings	33,084,470	32,149,672	2.9	..	..
Net earnings	16,636,365	16,675,040	—0.2	..	..
Oklahoma Gas & Electric (Year ended June 30)					
Gross earnings	14,676,253	13,189,989	11.3	..	..
Net earnings	6,867,985	6,392,662	8.3	..	..
Pennsylvania Power & Light (Year ended June 30)					
Gross earnings	30,666,497	29,657,843	3.0	50	50
Net earnings	15,503,142	14,828,477	5.0	..	..
Philadelphia Company (Year ended June 30)					
Gross earnings	63,225,026	62,592,411	1.0	..	..
Net earnings	31,063,184	30,078,917	3.3	..	..
Public Service Corporation of New Jersey & Subs. (Year ended July 31)					
Gross earnings	138,803,800	131,735,885	5.4	69	70
Net earnings	42,699,721	39,830,202	7.2	..	..
San Diego Consolidated Gas & Electric (Year ended June 30)					
Gross earnings	7,241,734	7,241,765	—0.0	..	..
Net earnings	3,467,610	3,471,454	—0.1	..	..
Texas Power & Light (Year ended June 30)					
Gross earnings	9,916,953	9,612,019	3.0	50	50
Net earnings	4,916,972	4,757,779	3.0	..	..
Utah Power & Light (Year ended June 30)					
Gross earnings	11,707,922	11,407,475	3.0	51	49
Net earnings	5,717,355	5,834,455	—2.0	..	..
Wisconsin Public Service (Year ended June 30)					
Gross earnings	5,598,355	5,259,241	6.5	..	..
Net earnings	2,424,065	2,302,200	5.3	..	..

Business News and Markets

INDUSTRIAL activity continues virtually static. Prophets of recovery are unable to present much tangible evidence of an upward turn. Yet a definitely encouraging feature of the situation is the improved tone of commodity markets and growing evidence that the commodity price decline has been arrested.

——THE EARLY WEEKS OF AUGUST SHOWED SIGNS of slight improvement in general trade.

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Lamp Works Holds Merchandising Conference

NEARLY A HUNDRED central-station executives attended the annual merchandising conference for central-station executives, held jointly this year by the Edison Lamp Works and National Lamp Works of General Electric Company on August 4, 5 and 6, at Nela Park, Cleveland. A valuable and complete coverage of the field of central-station merchandising activities was afforded by this series of addresses, which covered the field of lighting in its many aspects, merchandising practice, sales promotion and employee contests, store layout and arrangement, advertising by newspaper and direct mail, employee training and education, the customer's viewpoint, territory analysis and developing the market through co-operation with allied trades and industries. The list of speakers included not only men and women prominent in the lamp and central-station industry, but a number from other fields.

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Combustion Engineering Gets Boiler Contract

COMBUSTION ENGINEERING CORPORATION announces the receipt of a contract from the Brooklyn Edison Company for eight boilers and accessories, to be installed in the Hudson Avenue generating station. This contract amounts to more than $2,000,000. In addition to the boilers, the contract includes complete water-cooled furnaces, boiler settings and steel work, and economizers, all of which equipment is to be designed, manufactured and installed by the corporation. The boilers are of the Combustion Engineering bent-tube type, containing 24,450 sq.ft. of heating surface per boiler and equipped with "Elesco" superheaters. The design pressure is 500 lb. per square inch, with an operating pressure of 440 lb. at the superheater outlet.

All eight units are of identical design and are arranged for stoker firing. Each unit is designed for a maximum steam production of 530,000 lb. per hour. Four units are scheduled to be in operation by August, 1931, and the remaining four by January, 1932.

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Beauharnois Buys Equipment in Home Market

CANADIAN WESTINGHOUSE HAS OBTAINED the order for seven high-tension transformers for the Beauharnois Power Corporation's power house. The equipment is to be used to step up the voltage for transmission to Montreal Power and to the Ontario Hydro Electric. The capacity of the units totals 250,000 hp. Before the plant is brought up to its 500,000 hp. capacity, the corporation will place orders for about eight similar transformers.

Bond Market Foreshadows Business Upturn

"THE bond market record is being pointed to as the first definite statistical precursor of business recovery. Bond prices have moved upward almost uninterruptedly for a month and a half, too long to be classed as a temporary 'bulge,'" says *Business Week*.

"An upturn in bond prices always has been an important forecast of improvement in business. Stock and commodity prices are other significant indicators, but neither of these has yet definitely moved up. In the past, though, upturns in business activity, bond and stock prices have occurred in quick succession within a few months. Commodity prices frequently have accompanied them on the rise."

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Copper Moves Slowly at Current Prices

LITTLE ACTUAL CHANGE from a week ago can be reported in the copper market. It must be admitted, however, that consumers are not so anxious to buy copper at 10¾ cents as they were a week or two ago, and sellers at that figure are beginning to quote it to possible buyers rather than to parcel out their metal to favored customers. Any demand of consequence would quickly absorb all the 10¾-cent copper that is available, for all the large producers seem as firm as ever at 11 cents, but what demand there has been in the last two days could easily be met by the 10¾-cent sellers. Some copper continues to go on the books of producers at 11 cents, however, to regular customers and subsidiaries of certain producers, and where special shapes are involved, so that a range of 10¾ to 11 cents, delivered Connecticut, remains the nominal market.

	Aug. 20, 1930 Cents per Pound	Aug. 27, 1930 Cents per Pound
Copper, electrolytic	10¾	10¾
Lead, Am. S. & R. price	5¼	5¼
Antimony	7¼	7¼
Nickel, ingot	35	35
Zinc, spots	4.65	4.65
Tin, straits	30	30
Aluminum, 99 per cent.	23.30	23.30

No evidence is apparent that any change in the policies of any of the large producers is being considered. Should demand begin to pick up early in the fall, the situation is likely to right itself gradually without any marked change in production rates. Another increase in stocks of refined copper at producers' plants is not unlikely.

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Westinghouse Announces New Lamp Sale Plan

"THE MERCHANDISING DISTRIBUTION SYSTEM of this country has been rapidly changing," A. E. Allen, vice-president Westinghouse Lamp Company, said in announcing the new "Mazda" lamp sales plan and discount schedules for agents and purchasers, effective September 1, 1930. "Margins of profit which were considered adequate and equitable a few

years ago, in many cases can no longer be considered so now. The Westinghouse Lamp Company feels that dealers and jobbers are entitled to a more adequate compensation for properly functioning and rendering service, but, at the same time, the consuming public must not be called upon to meet this existing inadequacy."

Mr. Allen further said: "The three principal features of this new plan are:

First—It provides a higher rate of compensation for 94 per cent of the retailers of Westinghouse "Mazda" lamps.

Second—It more fully recognizes the proper function of the wholesaler and compensates accordingly.

Third—The special discount to be given for the purchase of any six or more lamps is also an important feature of the new plan.

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TRADE BRIEFS

Chase Brass & Copper Company has announced the opening of a new warehouse in Pittsburgh. Heretofore only a sales office was maintained there.

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The James R. Kearney Corporation, manufacturer of overhead and underground electrical specialties, 4224-40 Clayton Avenue, St. Louis, Mo., announces the purchase of the Thanders Electric Company, a St. Louis concern, maker of T-H equipment for central stations, line constructions, railway systems, industrials and substations.

•

The Reynolite division of the Reynolds Spring Company, Jackson, Mich., has become the wholly owned subsidiary of Cutler-Hammer, Inc. This transaction brings to Cutler-Hammer Reynolite products, including bakelite flush plates, plural plugs, etc.

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Brown Instrument Company, Philadelphia, has appointed R. C. Kennan as manager of the service department and E. T. Nahill as field supervisor.

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Electrical Manufacturing Slower in July

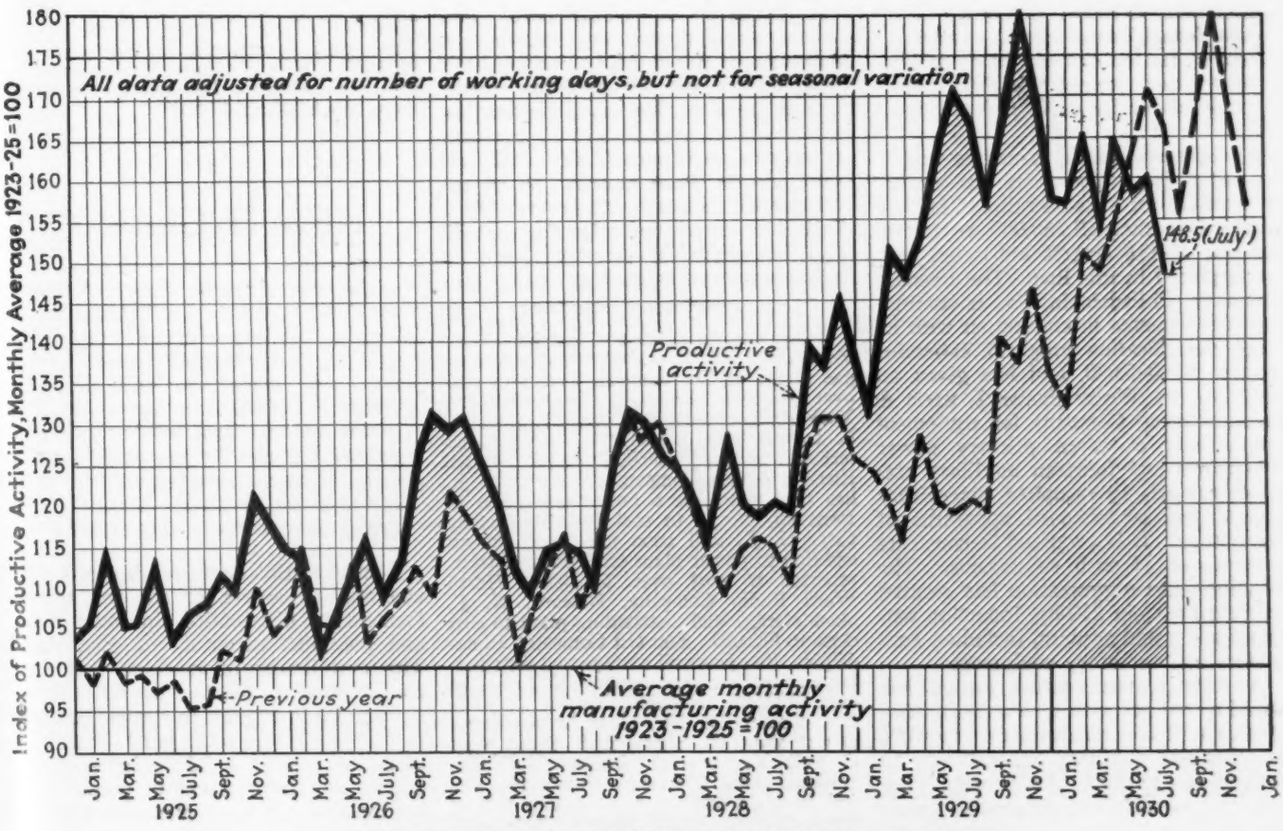
AS IN other industrial fields, July operations in plants manufacturing electrical equipment, apparatus and supplies were at a lower average rate than in those of June and of earlier months of the year, but were still up to the level of March, 1929. The measure of industrial activity here used is the electrical energy consumed. Compared with June, July shows a decrease of 7 per cent when the returns are adjusted for the difference in the number of working days, 26 in July against 25 in June. A seasonal decrease of 2.1 per cent would be normal. If only the monthly totals are considered, irrespective of the number of days, July returns show a decrease of only 3 per cent. The influence of July 5 falling on a Saturday cannot be evaluated, but should not be ignored in analyzing the data.

The change was virtually equal in both the large and the smaller electrical manufacturing plants, considering each group as a whole.

Indexes of Electrical Manufacturing

July, 1930	148.5
June, 1930	160.2
May, 1930	158.0
April, 1930	164.9
July, 1929	166.6
First seven months, 1930	158.0
First seven months, 1929	155.2

While the level for July was 10.8 per cent lower than in 1929, it was 23 per cent higher than in 1928. For the first seven months the average remains above that of the corresponding period of last year, the margin being 1.6 per cent.



BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES

Market Conditions

AUGUST closes with equipment business listless, as it has been most of the month. Buyers seem to be waiting for lower price levels and are postponing larger purchases, especially in the Eastern and New England districts.

——ON THE PACIFIC COAST SHOW WINDOW and sport-lighting installations are supplying the bulk of current business. Power apparatus is moving.

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EASTERN

—CLOSE OF AUGUST *with a holiday week-end shows little change in the market for electrical equipment in the Eastern district. With but slight exception, the past month has been extremely quiet and volume business has tapered considerably. A few major contracts form the one bright spot in a buyers' market where inquiries seem to forecast early improvement but where noticeable hesitancy exists in placing immediate orders. The general attitude seems to be one of waiting for lower price levels.*

—ELECTRIC RAILWAY ACCOUNT *has recorded additional sizable business; central station demand holds fairly active and presents a little encouragement for early fall months.*

An Eastern manufacturer has secured an order for a group of ten electric locomotives for a steam railroad in New England, totaling $1,750,000, representing one of the largest individual contracts placed in this line. The Reading Company, Philadelphia, Pa., is continuing commitments in connection with its large electrification program, estimated to cost $20,000,000, and has given an order to the Westinghouse Electric & Manufacturing Company for equipment for a total of seven primary power substations and fourteen auxiliary stations, comprising complete supervisory control and switchboard apparatus of heavy type. It is proposed to construct a group of 24 such substations. The Westinghouse organization has secured an award for six 250-hp. induction motors for Russian account, including controllers and accessory equipment.

A metropolitan central station has placed a contract with a New York manufacturer for transformers, network switches and auxiliary apparatus to an amount of $150,000. An Eastern manufacturer of cable has received an award from a Pacific Coast city for a quantity of lead-covered cable, approximating $11,800. A Middle West maker of prime movers will furnish two units, Diesel engine type, for a municipal installation in Mississippi, including exciter, switchboard and accessories, totaling $65,000. An Eastern producer of engines has an award for an installation for a municipality in Kansas, approximating $45,000. One of the most important industrial contracts recently placed has been given by the Shell Chemical Company, a subsidiary of the Shell Petroleum Company, to the Electric Machinery Manufacturing Company for an installation at a new plant in California, including two 100-kw. motor-generator sets, a 24-panel switchboard, and eleven synchronous motors, ranging from 200 to 1,000 hp. capacity.

A producer of switchboards and switchboard equipment says that there is improvement in buying and orders have been heavier for the past few weeks than at any time this year; the first six months shows a decline of 50 per cent in business as compared with 1929 account for the same months. A manufacturer of industrial motors reports a decline in commitments for the past 30 days, but says that incoming inquiries indicate reasonably early revival.

CONSTRUCTION PROJECTS

Union Carbide & Carbon Company, New York, plans industrial oxygen and acetylene gas plants at Chattanooga, Tenn., to cost over $400,000. Bee Line, Inc., and New York Avenue Holding Company, Jamaica, L. I., will build a motor bus garage and terminal to cost $1,500,000. Public Service Electric & Gas Company, Newark, N. J., has filed plans for a power substation at Paterson, N. J., to cost $60,000. Jersey City, N. J., will soon take bids for an addition to power plant on Baldwin Street, reported to cost over $100,000. North Ward Radio Company, Newark, N. J., plans storage and distributing plant to cost close to $85,000. Sun Oil Company, Philadelphia, Pa., plans oil storage and distributing terminal at South Amboy, N. J., to cost over $100,000. Republic Service Corporation, Coatesville, Pa., plans hydro-electric power plant on Shenandoah River, near Overall, Va., to cost close to $1,000,000. National Tube Company, Pittsburgh, Pa., will build an addition to steel tube mill at Gary, Ind., to cost close to $2,000,000. Hercules Power Company, Wilmington, Del., has acquired property near Port Huron, Mich., and contemplates a nitrocellulose plant to cost over $200,000. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until September 9 for transformers, oil circuit breakers, cable wire, etc. (Panama Schedule 2583.)

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SOUTHWEST

—CAREFUL BUYING OF STOCK SIZES *of all apparatus has marked the past week. Demand has been steady and there have been several fair-sized shipments of pole line materials. Some of the power companies have announced that they are to begin important additions to their transmission systems.*

An order amounting to $30,000 for an oil circuit breaker is now under construction. A lot of motors for a cotton ginning company in northeast Arkansas to cost $3,300 is the only order of any size reported.

CONSTRUCTION PROJECTS

Shell Petroleum Company, St. Louis, Mo., will build a gasoline refining plant near Hobbs, N. M., to cost $750,000. Altus, Okla., has authorized immediate construction of a municipal electric light and power plant to cost over $75,000. Phillips Petroleum Company, Bartlesville, Okla., plans oil plant near Hobbs, N. M., to cost over $400,000. McAllen, Tex., contemplates a municipal electric light and power plant. Kimball Milling Company, Fort Worth, Tex., plans grain mill to cost close to $100,000. New Orleans Public Service, Inc., New Orleans, La., plans mechanical shops to cost about $70,000

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NEW ENGLAND

—LITTLE ACTIVITY DURING THE PAST WEEK *is reported by manufacturers in this district. Negotiations are lagging and inquiries are dropping off. Sales recorded consist of scheduled materials and power equipment in small lots. Small motor sales are fair, but behind the volume reported for this month last year. Control apparatus sales are correspondingly slack. Orders for heavy equipment are at a standstill.*

Central station supplies are spotty and confined to single orders for transformers for distribution line extensions and pole line materials in small lots. The curtailment of machine tool and metal working plants has reflected a slowing up in interest in electric heating furnaces. On the other hand, one manufacturer reports a fair volume of inquiries and information in preparation for the resumption of plant activity.

Interest in outside illumination projects is maintained and lighting units continue to be the strong feature in spe-

cial equipment. Merchandising reports show a decline in sales volume. A number of large wiring contracts for schools and hospitals were recently bid in. A sharp decline in new house meter installations in this district is reported for the half year.

CONSTRUCTION PROJECTS

Cambridge Industrial Trust Company, Cambridge, Mass., has filed plans for a power plant to cost about $40,000. Taunton, Mass., has taken out a permit to build a power substation to cost about $50,000. F. S. Webster Company, Cambridge, Mass., has filed plans for an addition to typewriter supply manufacturing plant to cost over $100,000. Howard Company, New Haven, Conn., contemplates a brick manufacturing works to cost over $125,000. United Airports of Connecticut, Inc., Hartford, Conn., plans installation of lighting system at proposed airport, entire project to cost over $90,000.

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SOUTHEAST

—THERE SEEMS TO BE NO PERCEPTIBLE CHANGE *in general business conditions throughout the Southeastern territory, but sales volume continues at about the same level.*

A Florida paper mill placed an order for switchboard material during the week, an electric utility in Tennessee placed an order for insulators to the amount of $8,000, one Southern municipality ordered street lighting equipment to the amount of $5,000, and a Southeastern distributor received orders during the weeks as follows: Motors, $1,500; burglar alarm system for municipality, $2,000; wiring for new building in Atlanta, $1,000. One Southern cotton mill has announced plans for revamping machinery layout with the consequent purchase of additional electric machinery and a Southeastern utility placed an order during the week for twenty high-tension transformers, aggregating 5,750 kva., and in addition placed miscellaneous orders as follows: Insulators, $10,000; pole line hardware, $7,000; crossarms, $2,000; distribution transformers, $4,500; switchboard instruments, $2,100; metering equipment, $2,450, and miscellaneous equipment, $2,450.

CONSTRUCTION PROJECTS

Virginia Electric & Power Company, Richmond, Va., plans extensions in transmission lines in vicinity of Hopewell, Va., about 30 miles. Muddleston Mahogany Company, Norfolk, Va., is reported planning mill to cost about $100,000. Appalachian Electric Power Company, Bluefield, W. Va., plans double-circuit transmission line in vicinity of Belle, W. Va., reported to cost over $75,000. Mountain Power Company, Chattanooga, Tenn., plans hydro-electric power plant on Tellicoe River to cost over $700,000. Fort Myers, Fla., contemplates a municipal electric light and power plant.

PACIFIC COAST

—IT IS NOTICEABLE HOW ONE LINE *or one class of trade is carrying the burden of business. For example, show window and sport lighting installations are providing the bulk of the wiring jobs and machinery firms report that their orders come chiefly from power companies despite a state-wide stock-taking and reallocation of machinery.*

—COMPETITION HAS BEEN INTENSIFIED *because contractors have cut their crews to a skeleton organization and many ex-employees are rustling jobs for themselves. Encouraging features are bumper crops and healthy credit conditions; collections are still running close to 40 days.*

Power apparatus orders include $15,000 pumping motors for Los Angeles, two General Electric 90-hp. mechanical drive turbines valued at $4,000, generator repair parts for an East Bay utility valued at $12,000 and metal-clad General Electric switching equipment for station G, San Francisco. Small motors and industrial equipment are very slow, although the Pittsburg plant of the Shell Oil Company will require ten motors, sizes 600 to 1,000 hp.; two 100-kva. motor-generator sets and a 24-panel switchboard. Projected industrial plants include a $500,000 filter plant for Fruitvale, a $1,000,000 underwear factory for Los Angeles and a $700,000 drug warehouse for southern territory. August elections include many large bond issues, such as an $85,000,000 proposal for city of San Francisco to take over private power systems, a $31,000,000 similar proposal for Los Angeles and a $4,000,000 bond issue to enlarge and properly light Mills flying field near San Francisco.

Although sales of motors, apparatus, poles and pole line hardware are light, indications point to marked improvement within not less than 60 days. Sales last week reported at minimum, but numerous inquiries were received. Portland Canal Power Company, of which W. T. Batcheller, Dexter Horton Building, Seattle, is president, plans a $3,000,000 hydro-electric project at Hyder, Alaska, developing 20,000 hp. ultimately. City Council at Hood River, Ore., has approved plans and specifications for a $53,000 municipal hydro-electric plant voted by citizens. Plans are being completed for a $5,000 light plant at Taholah Indian reservation by the Indian agency, near Hoquiam, Wash., and the Meier & Frank department store in Portland seeks bids for a power plant.

CONSTRUCTION PROJECTS

Consolidated Steel Corporation, Los Angeles, Calif., has plans for iron and steel plant at Maywood, consisting of ten buildings and power plant, to cost $1,000,000. Santa Fe Railway Company, Los Angeles, Calif., plans shops and terminal at San Diego, Calif., to cost over $400,000. San Francisco, Los Angeles, Whittier and Oakland, Calif., plan ornamental lighting systems. California-Oregon Power Company, Medford, Ore., plans hydro-electric power project on North Umpqua and Clearwater Rivers to cost more than $15,000,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until September 9 for two generating units, oil engine driven (Schedule 3963). Montana Power Company, Butte, Mont., plans power substation at Livingston, Mont., to cost $75,000. R. D. Webb, Lake City, Colo., and associates plan hydro-electric power plant on Gunnison River to cost $400,000, and have applied for permission. Arizona Imperial Mines Company, Fort Huachuca, Ariz., plan power plant and flotation plant to cost over $175,000.

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MIDDLE WEST

—WHILE DEFINITE SIGNS OF IMPROVING BUSINESS *in the Middle West section are rather obscure, the consensus of opinion seems to be that general business is slightly better and is definitely expected to pick up next month.*

Transportation companies have started some of their contemplated extension work, while an application has been filed by the elevated railroads of Chicago with the utility commission to allow a bond issue of $6,500,000 for immediate construction work. The major activities, steel, railroad, automotive and electrical industries, are maintaining their positions, while industrial activity has increased slightly. The various utility companies are preceeding conservatively and a substantial fall program is contemplated. Some of the interesting items placed this week include a contract for heating and ventilating equipment to cost $87,500 and several construction orders.

CONSTRUCTION PROJECTS

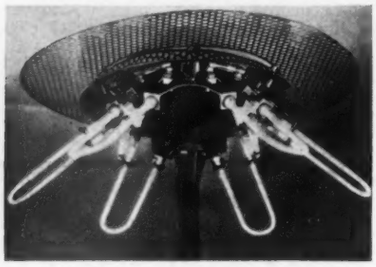
Cooper's, Inc., Kenosha, Wis., plans knitting mill at Los Angeles, Calif., to cost over $1,000,000. Standard Oil Company of Indiana, Chicago, Ill., plans oil refinery at Casper, Wyo., to cost over $1,000,000. Waukegan, Ill., plans installation of ornamental lighting system. Servel Corporation, Evansville, Ind., will carry out an expansion program at refrigerator manufacturing plant to cost over $250,000. Richmond, Ind., plans addition to municipal electric light and power plant. Michigan United Light & Power Company, Ludington, Mich., plans power plant near Traverse City, Mich., to cost over $300,000. Metal Process Corporation, Detroit, Mich., has plans for a plant to cost about $200,000. Grand Haven, Mich., will make extensions and improvements in municipal power plant to cost $238,000. Board of Water Commissioners, Detroit, Mich., will take bids for a generating station to cost about $200,000. Iowa Public Service Company, Fort Dodge, Iowa, plans transmission line from Cherokee to Aurelia, Iowa.

New Equipment Available

Neon Tube Markers Insure Protection

NEON TUBE AIRPLANE GUIDE and obstruction markers composed of six U-shaped Neon tubes are announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. These markers are effective and distinctive, according to the manufacturer.

The tubes are connected in series, but



in event any one of them becomes defective it is eliminated from the circuit by an automatic cutout. The marker will remain in service as long as one active tube is left, and the possibility of all of them burning out is far remote. This provides a reliable protection for aviators.

A transformer mounted under the hood adapts the markers to use on low-voltage lines, the one shown in the illustration being for 110-220 volts. When used for marking transmission towers, or any other structure where high voltages are available, the marker may be connected directly across the line.

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Electric Automatic and Remote Control

AUTOMATIC AND REMOTE CONTROL of industrial machines, where speed regulation of individual machines or synchronization of two or more machines is desired, may be obtained by the use of the control equipment placed on the market by the Reeves Pulley Company, Columbus, Ind. By means of this machine speeds may be infinitely regulated over a predetermined range between fast and slow, according to the manufacturer.

The electric automatic control comprises a fractional-horsepower motor, a train of reduction gears connecting the motor shaft to the shifting screw of the transmission, a safety slip clutch which allows the large gear to slip in case the shifting screw locks or in event of sudden overload, a solenoid brake, which is thrown on when the required speed is obtained, and a two-way mercury switch for running the reversible motor in either direction. The remote control differs from the automatic control only in the operating switch.

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TINNED SPLICING SLEEVES OF PURE COPPER have recently been placed on the market by the H. B. Sherman Manufacturing Company, Battle Creek, Mich. This product, known as the Sherman sleeve, is carefully made to conform with specifications prepared by the N.E.L.A., according to the manufacturer. It claims ample strength and freedom from overheating.

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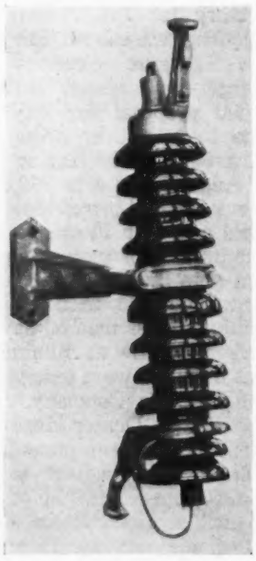
Self-Insulated Expulsion Fuses

EXPULSION FUSES FOR 7.5-kv. to 37-kv. service, which depart distinctly in design from the older types, are announced by the Champion Switch Company, Kenova, W. Va.

The new design lies in the carrying of the fuse tube proper in a wet-process

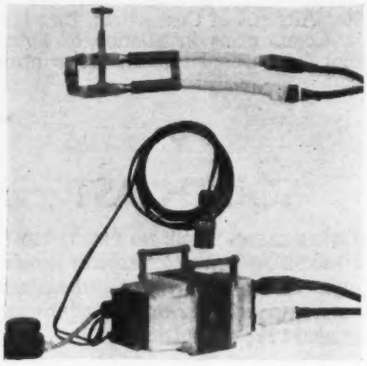


corrugated bushing mounted on a malleable iron clamp, an arrangement which eliminates the usual supporting insulators. The fuse tube projects beyond the porcelain bushing, affording a long air gap after the fuse blows. The upper end of the tube carries a cap which may easily be removed for inserting a new fuse wire.

Portable Equipment for Electric Brazing

BRAZING BY HEAT GENERATED by the flow of current through carbon blocks is accomplished by a new line of electric brazing equipment announced by the General Electric Company, Schenectady.

The equipment consists of a transformer, foot switch and tongs for holding the carbon blocks and the work. The sizes of the various parts depend upon the size of the work to be handled and the length of the joints to be made. A typical set of the equipment uses a 5-kva. 45-lb. transformer with a 220-



volt primary and an 8-volt secondary. A 10-kva. transformer for heavier duty weighs 95 lb. and has the same primary with 8-, 10- and 12-volt taps on the secondary.

The method and equipment for electric brazing are simple and inexpensive, according to the manufacturer. This type of brazing is said to offer a saving of time and joints of higher conductivity, mechanical strength and durability as compared to soldering.

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Two-Pole Starters with Overload Relays

TWO-POLE ALTERNATING- AND DIRECT-CURRENT starters with overload relays for starting small motors are announced by the Industrial Controller Division of the Square D Company, Milwaukee, Wis. These starters have silver contact points, floating contactor armature, and two-pole, double-break contacts. The overload relay is of the thermal time limit type with external reset button in the cover. Low-voltage release is provided with two-wire control and low-voltage protection is provided with three-wire control.

The starters are designated as class 8531 a.c. two pole and class 8731 d.c. two pole. They are made in type B-1 for two- or three-wire control and type C-1 for two-wire control with a three-point switch for manual, off and automatic operation.